SIMRAD

Master the Elements

Installation manual

Simrad AP50
Autopilot
Plus system

English

Sw.1.3

INSTALLATION MANUAL

SIMRAD AP50

Autopilot
Plus System

20222410/B Sw. 1.3. English

About this document

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Rev. B	Minor corrections

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Installation Manual

This manual is intended as a reference guide for the correct installation and commissioning of the Simrad AP50 Autopilot Plus System

Great care has been taken to simplify the installation set-up of the AP50; however, an autopilot is a complex electronic system and particular attention has to be paid by the installer.

Please take the time to read this manual together with the Operator Manual to gain a thorough understanding of the Simrad AP50 autopilot system components and operation, as well as their relationship to a complete AP50 Plus system.

Note !

The AP50 Plus is an upgraded version of the AP50 Autopilot System. A full range of new distribution units (JD50, JD51, JD52 and JD53) are offered to cover the applications and performance of the well recognized AP9Mk3 Autopilot.

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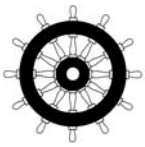
1 GENERAL INFORMATION

1.1 Introduction



The AP50 Plus system is produced and tested in accordance with the European Marine Equipment Directive 96/98. This means that the AP50 complies with the highest level of tests for non-military marine electronic navigation equipment existing today.

The Marine Equipment Directive 96/98/EC (MED), as amended by 98/95/EC for ships flying EU or EFTA flags, applies to all new ships, to existing ships not previously carrying such equipment, and to ships having their equipment replaced.

This means that all system components covered by annex A1 must be type-approved accordingly and must carry the Wheelmark, which is a symbol of conformity with the Marine Equipment Directive.

While the AP50 may be installed on vessels not needing to comply with the Marine Equipment Directive, those requiring compliance must have one AP50 Control Unit set-up as a "master unit" in order for the installation to be approved. Simrad has no responsibility for the incorrect installation or use of the AP50 autopilot, so it is essential for the person in charge of the installation to be familiar with the relevant requirements as well as with the contents of this manual, which covers correct installation and use.

The purpose of the Marine Equipment Directive is to enhance safety at sea and to prevent marine pollution through the uniform application of the relevant international instruments relating to equipment listed in Annex A1.

As there are many interfacing requirements in the standards/codes, integrated systems and integrated certification lead to more efficient and effective management of safety, environmental, issues and quality.

The Marine Equipment Directive also constitutes a part of the International Safety Management (ISM) Code. The ISM Code was included as a new chapter (IX) of SOLAS in 1994, and is mandatory for: passenger ships not later than 1st of July, 1998; oil tankers; chemical tankers; gas carriers; bulk carriers and cargo high speed craft of 500 gross tonnage and upwards not later than 1st of July, 1998; and other cargo ships and mobile offshore drilling units of 500 gross tonnage and upwards not later than 1st of July, 2002.

It is required that both the shipping company and ships shall be certified by the Administration (the government of the state whose flag the ship is entitled to fly), by an organization recognized by the Administration or by the government of the country acting on behalf of the Administration.

1.2 How to Use This Manual

This manual is intended as a reference guide for installing and commissioning the Simrad AP50 Autopilot Plus System. Great care has been taken to simplify the set-up and operation and of the AP50; however, an autopilot is a complex electronic system. It is affected by sea conditions, speed of the vessel, and vessel hull shape and size.

Please take the time to study the manual carefully together with the Operator Manual to get a thorough understanding of the autopilot system components and their relationship in a complete AP50 Autopilot Plus System.

Particularly when setting up and commissioning the system it is important to have both manuals at hand.

At the end of this manual, you will find an index and a glossary, which will help you when studying the manual.

Copies of approval certificates are included in the last section (9) of this manual.

2 INSTALLATION

2.1 General

This section provides detailed information required to properly install the AP50 Autopilot Plus System.

The AP50 plus system includes several modules that need to be mounted in different locations on the vessel and that need to interface with at least three different systems on the boat:

- The boat's steering system
- The boat’s electrical system (input power)
- Other equipment onboard (NMEA interfacing)

In addition, the advanced capabilities of the AP50 require the installer to perform a series of settings and tests to verify proper operation of the system (refer to the Installation Index below).

2.2 Unpacking and Handling

Care should be taken when unpacking and handling the equipment. A visual inspection should be made to ensure that the equipment has not been damaged during shipment and that all parts are present according to the packing list.

A standard scope of supply for a basic AP50 system may include:

- A control unit with standard installation accessories
- A distribution unit (JD50, JD51, JD52 or JD53) and one 15 m (49 ft.) Robnet cable
- An RC25 Rate Compass with one 15 m (49 ft.) cable attached
- An RF14XU Feedback unit with transmission link (or optional feedback unit)
- An appropriate drive unit for the installation (unless the AP50 is going to operate an existing drive unit)
- Any optional equipment that may have been ordered for the installation

2.3 Installation Index

1. Determine the system configuration to be installed (see page 4)
2. Perform the hardware installation (see page 6)
3. Connect the external NMEA devices (inputs and outputs; see page 43)
4. Set the language (see page 52)

5. Select the dockside settings and perform tests (see page 51)
   a) Master operation
   b) Boat type selection
   c) Boat length selection
   d) Drive unit voltage selection.
   e) Rudder calibration
   f) Automatic rudder test
   g) Rudder limit
   h) Rudder deadband
   i) Thruster type (optional)
6. Interface set-up for Distribution Unit, GI51 and NI300X (if installed; see page 59)
7. Select the settings in the User Set-up Menu for Speed source, Compass source, and Nav. source. Ref. AP50 Operator Manual.
8. Perform the autopilot pre-tests at the dock (refer to Operation Instructions in the AP50 Operator Manual)
   a) Test all units (if applicable) - lock/unlock - active/inactive
   b) Test the Non-Follow-up mode
   c) Test the Follow-up mode
   d) Test the AUTO mode
   e) Test the AUTO-WORK mode
   f) Test the NAV mode and input the interfaces (if connected), including optional heading sensors
   g) Test NAV-WORK mode
   h) Test the interface outputs to the external equipment (if connected)
9. Select the Sea trial settings (see page 66)
   a) Compass calibration
   b) Compass offset adjustment
   c) Thruster adjustment (if connected)
   d) Speed source
   e) Set cruising speed
   f) Set rudder zero
   g) Set rate of turn (important)
   h) Manual tuning
   i) Automatic tuning
   j) Speed response
10. Testing the autopilot operation at sea (refer to Final Test on page 77)
11. Provide the user with training (see page 78)

2.4 Determining System Configuration

It is important to become familiar with the configuration of the system prior to beginning the installation. The AP50 Plus system with options is shown in Figure 2-1 on page 5.

Pay particular attention to the distribution unit/steering gear combinations on page 13 and the cable length and number of Robnet units on page 32.

As many of the units are communicating on a common network (Robnet) with identical connectors, the installation is simplified. Mount the units within the standard cable length supplied with each unit, if possible (refer to Technical Specifications, section 5, beginning on page 95. Robnet Extension Cable (10m) is available from your Simrad distributor. Refer to the Spare Parts List on page 95 for part numbers.

2.5 AP50 Plus System Layout

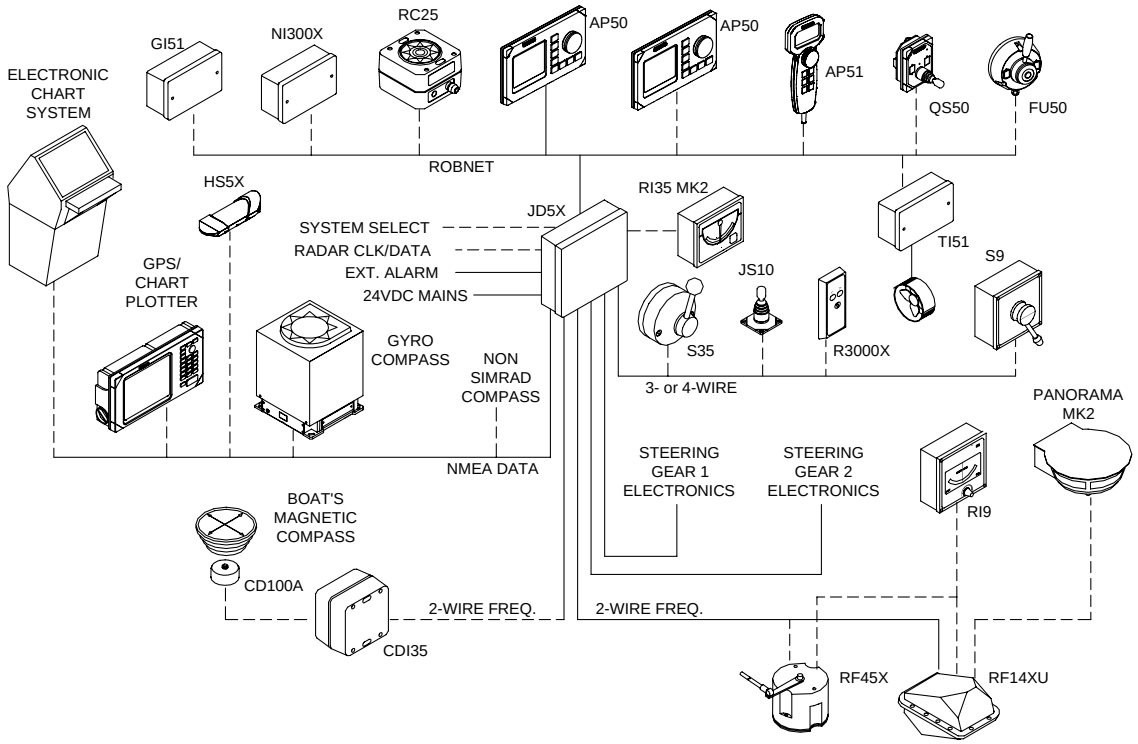


Figure 2-1 AP50 Plus system with options

Notes!

The plus system layout does not show all possible layouts.

With analog steering gear interface (JD53) the rudder feedback (RF45X, RF14XU) are not required.

2.6 RF14XU Rudder Feedback Unit

Mechanical mounting

Before installation, check that the alignment mark on the mounting plate agrees with the mark on the shaft. Bring the rudder to Midships position. The feedback unit should be mounted on a plane surface and secured by bolts through the three holes in the mounting plate. It should be linked to the rudder in accordance with Figure 2-2. It is important that the linkage is linear, i.e. the A-a and D-d are pairs of equal length. This will give a ratio 1:1 between the rudder angle and that of the feedback unit shaft. Final adjustment is made by loosen the fixing screws for the potentiometer, and carefully turn the potentiometer for correct positioning.

Note ! *If the RF14XU is mounted with the shaft pointing upwards, the yellow and the blue lead to the potentiometer inside must be interchanged (See Figure 2-4).*

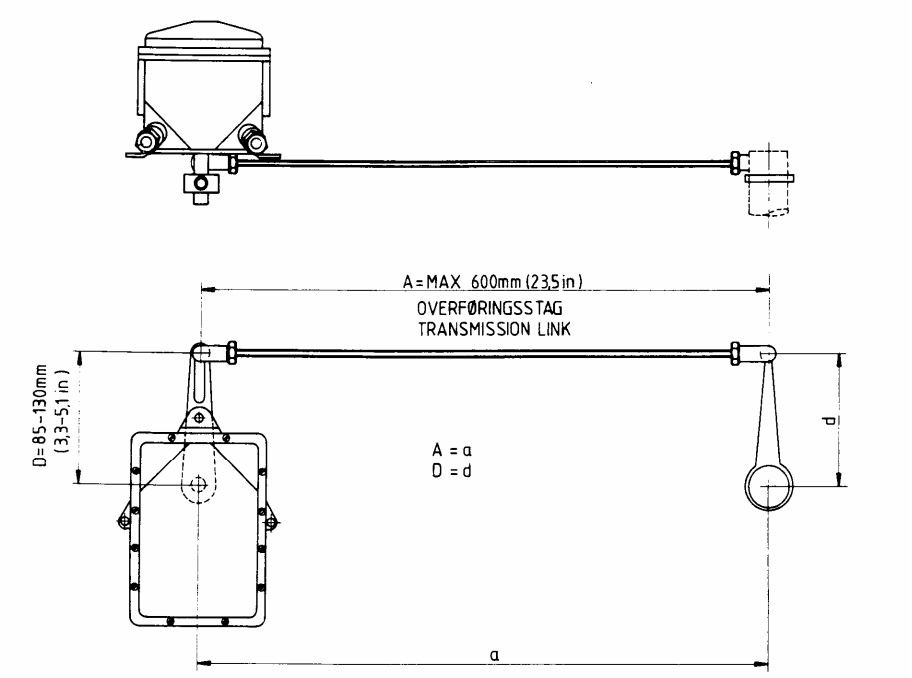


Figure 2-2 RF14XU - Mounting

Electrical installation

The cables are carried through cable glands. If required, to avoid any mechanical damage, the cables should be run in a conduit between the rudder feedback unit and the junction unit or rudder angle indicator. Electrical connection is shown in the cabling diagram. The cable screen must be connected to the internal ground terminal. Ref. Figure 2-3.

The feedback unit has an external ground terminal and must have a proper ground connection to the hull. The grounding wire should be as short as possible and at least 10 mm wide.

The RF14XU can be powered either from the rudder angle indicator supply (19-40V DC) or directly from the autopilot distribution unit. If a rudder angle indicator is connected, the RF14XU is powered from the rudder angle indicator supply. If the rudder angle indicator voltage disappears, or rudder angle indicator is not connected to the RF14XU, the feedback unit is powered directly from the autopilot. The change over is done automatically.

Note !

If RF14XU is connected to rudder angle indicators, and the indicators are powered from an unfiltered 24V supply, the enclosed 470uF capacitor should be connected across the supply. Without the capacitor, a deviation may occur between the autopilot feedback midposition reference and that of the rudder angle indicator(s). Scaling of rudder angle of indicators may be required. Refer to Figure 2-4, note 2.

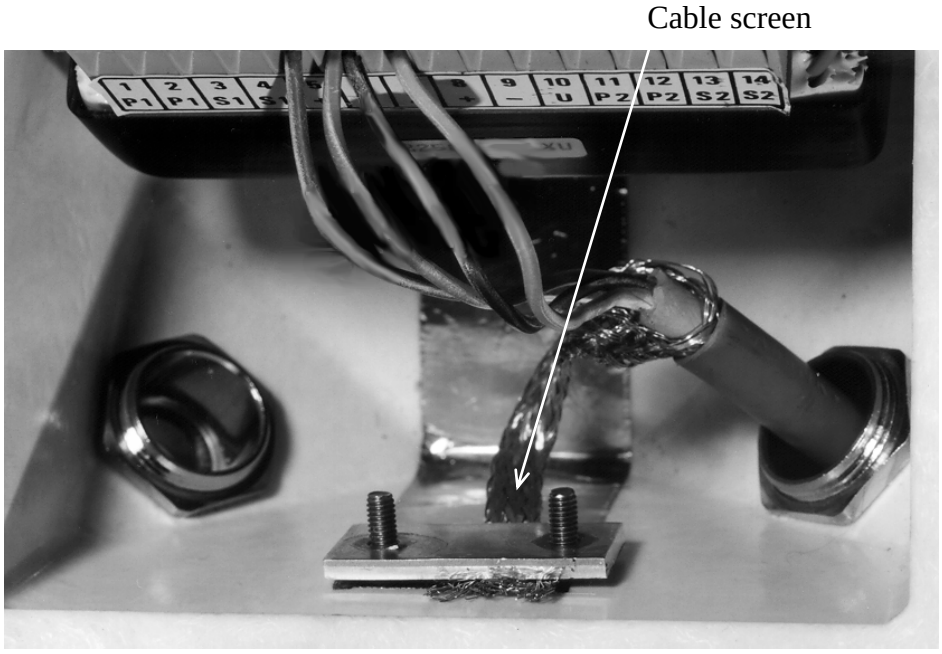
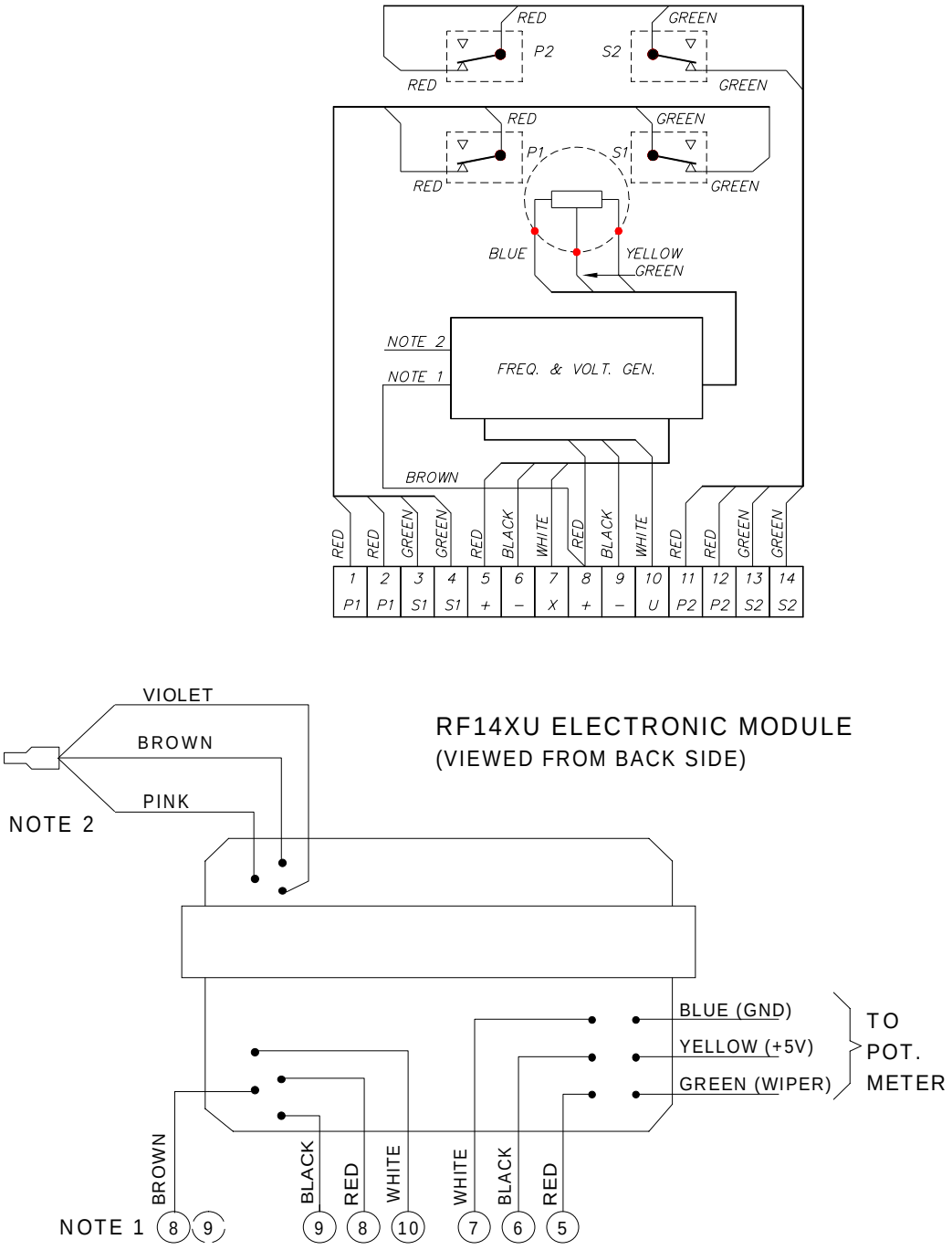


Figure 2-3
Screen termination



NOTE 1: Brown lead normally connected to (8). Move to (9) to invert the rudder indicator deflection.

NOTE 2: Normally connected for +/-45˚ rudder angle (violet, brown and pink leads are not connected). For +/-60˚ connect brown lead to terminal 10, for +/-70˚ connect pink lead to terminal 10, for +/-90˚ connect violet lead to terminal 10. White lead must remain connected.

Figure 2-4
RF14XU Internal wiring

Figure 2-5 shows how to connect the RF14XU Rudder Feedback Unit to an AP50 system with 24V autopilot supply.

The RI9 Rudder Angle Indicator is connected to the U-terminal on RF14XU, while RI35 Mk2 Rudder Angle Indicator is connected in parallel with the feedback signal for the distribution unit. Use the same supply for RI35 Mk2 as for the autopilot.

The connection shown below gives full functioning indicator(s) also with the autopilot switched off. To have the indicator(s) switched off with the autopilot, connect indicator(s) and rudder feedback supply+ to JD5X Vbat+ instead of JD5X Supply+.

Note ! *This configuration is only for 24VDC.*

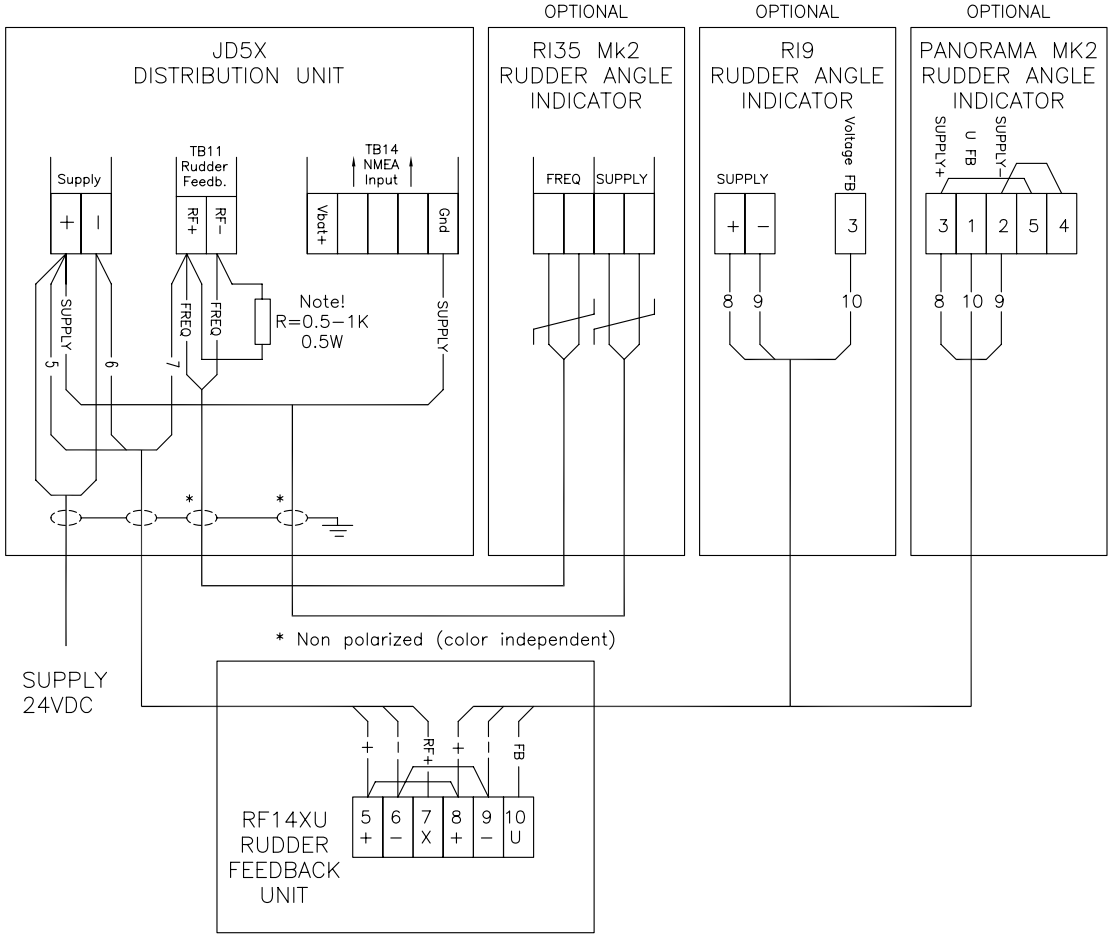


Figure 2-5 RF14XU connected to an AP50 system and optional rudder angle indicators

Note ! *The resistor R (0.5-1K, 0.5W) has to be mounted. The resistor is not supplied by Simrad.*

Final check

After installation, the cable glands must be sealed with silicon to prevent water from seeping in. Also apply silicon grease to the gasket between the bottom and top cover.

On the inside of the feedback unit cover, a piece of moisture protecting sponge is attached. The sponge produces a corrosion preventive gas, and to increase the efficiency of the gas the cover must be kept tight.

2.7 RF45X Rudder Feedback Unit

(The RF45X can be used instead of RF14XU when limit switches are not required).

The RF45X Rudder Feedback Unit is normally installed with the shaft pointing upwards. However, it can be mounted with the shaft pointing downwards for increased convenience. The deflection can then be inverted in the AP50 software or as illustrated in Figure 2-7 on page 11. An “upside-down” installation will make access to the unit more efficient as it can be opened without moving it from the mounting base. To open the unit, unscrew the two screws of the unit and remove the cover. Be careful not to damage the wires when you replace the cover.

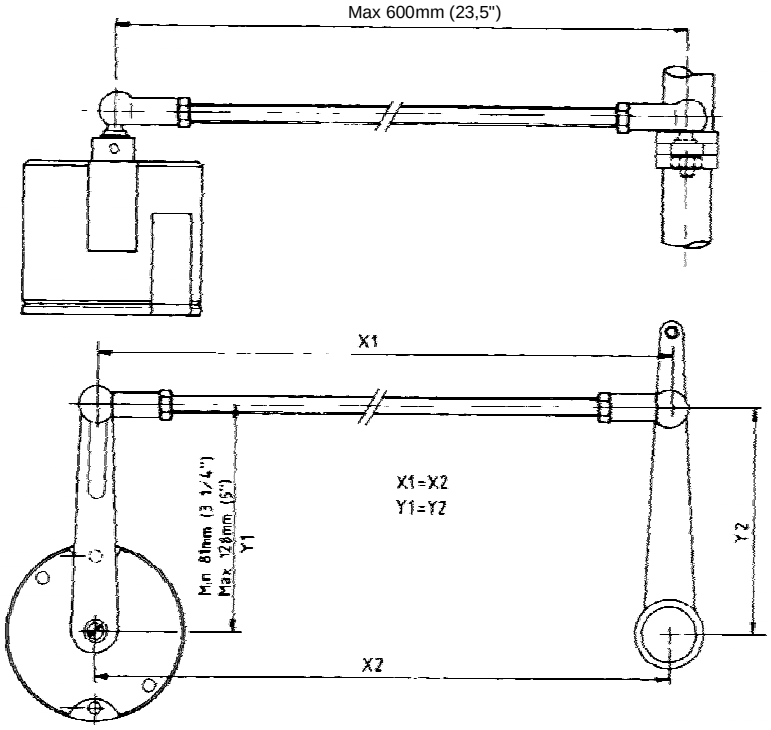


Figure 2-6 RF45X Rudder Feedback Unit Mounting

Use the enclosed template (Drawing 22011225) to drill the required mounting holes. The unit is fastened to the mounting base by the two Allen screws enclosed (other types of screws may be used if it is to be fastened to another type of base, i.e. a wooden base).

Make the parallelogram configuration of the transmission link (see Figure 2-6) and temporarily fasten the link to the RF45X shaft. The transmission rod can be shortened by cutting off a piece using a hacksaw. Move the rudder manually hard over to hard over and make sure the transmission link is moving freely in both directions.

Electrical Connection

Use a twisted-pair shielded cable, 0.5 mm^2 (AWG20), between the breakout box and the JD5X Distribution Unit. The cable length is not critical but should be kept to a minimum.

The cable should be connected to the distribution unit according to Figure 2-7. When splicing the cables in the breakout box, crimp the enclosed pins on each wire of the extension cable to avoid cutting off the wires at the terminal point when the screws are tightened.

The screen must be connected in the distribution unit.

Note ! *The green and yellow wires are not used and must be isolated!*

For final alignment, see page 13.

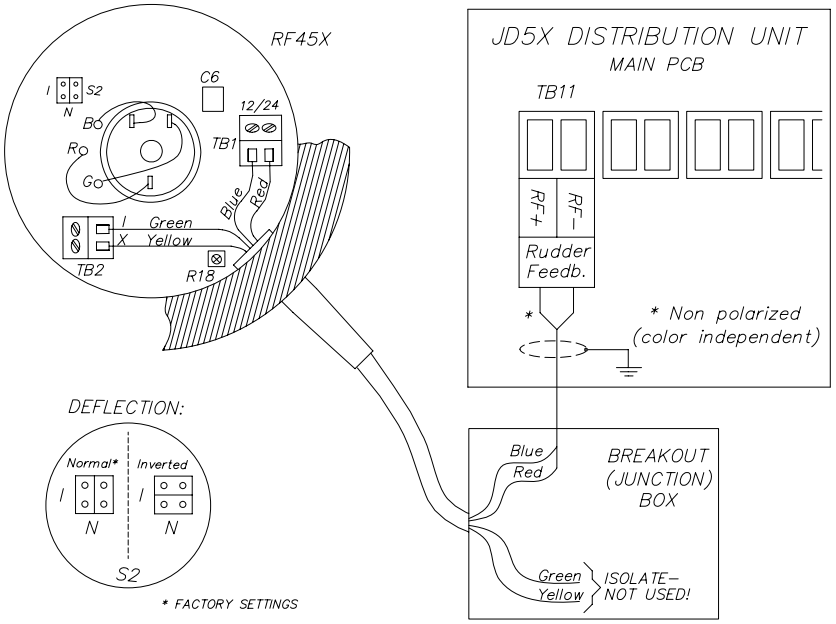


Figure 2-7 RF45X Rudder Feedback Unit Connection

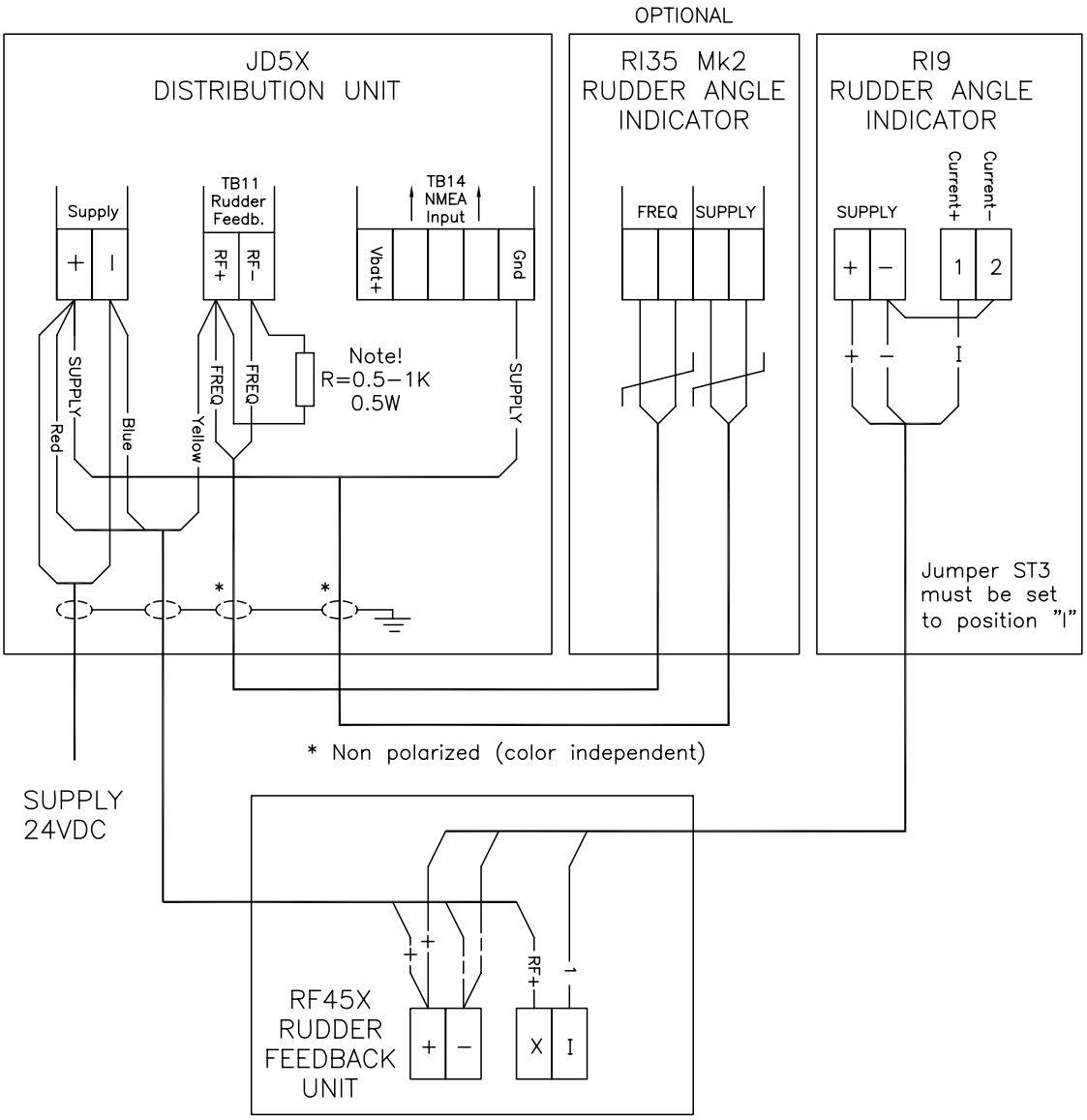


Figure 2-8 RF45X Connection to RI9 Rudder Angle Indicators and RI35 Mk2 (optional)

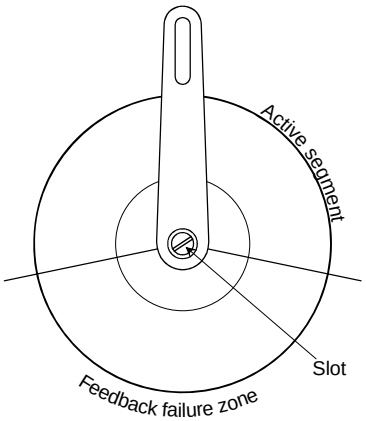
The above connection diagram shows how to connect an RI9 Rudder Angle Indicator to a system with RF45X Rudder Feedback Unit. For connection of RI35 Mk2 Rudder Angle Indicators only, refer to the RI35 Mk2 manual.

This connection gives full functioning indicator(s) also with the autopilot switched off. To have the indicator(s) switched off with the autopilot; connect indicator(s) and rudder feedback supply+ to JD5X Vbat+ instead of JD5X Supply+.

Note ! *A resistor R (0.5-1K, 0.5W) has to be mounted. The resistor is not supplied by Simrad.*

Mechanical Alignment

The purpose of this procedure is to find the zero point and to allow the feedback unit to operate within its active segment. If the unit operates outside this segment, there will be a feedback failure alarm.



1. Position the rudder amidships.
2. Loosen the two screws that secure the transmission lever to the RF45X shaft.
3. Turn on the autopilot by pressing the (STBY) button and wait until the start-up sequence is finished.
4. Press the (STBY) button again, if necessary, to read the rudder angle display. You may also read the rudder angle by accessing the User Set-up menu (see Operator Manual) and the SYSTEM DATA menu (page 79).
5. Use a flat screwdriver in the slot and adjust the rudder angle to zero degrees on the display.
6. Secure the transmission lever to the shaft. Return to the Dockside settings and proceed to '*Rudder Feedback Calibration*'.

Note !

If the autopilot presents a Rudder Feedback Alarm after "turn on", proceed as follows:

- *Turn the autopilot off. Use a flat screwdriver in the slot and turn the shaft 180°.*

Proceed from item 3 above.

2.8 JD5X distribution units

General

The following versions of JD5X distribution units are available:

JD50 Distribution unit (P/N 20126819)

JD50 provides solid state switching (ON/OFF) of two independent sets of directional valve solenoids, 19-40V DC, 3A.

The unit includes the following circuit boards:

- J50 Power Board ..... P/N 20212528
- J50 Main Board ..... P/N 20211918

- D9X Solid State Board, 19-40VDC (2 pcs.) P/N 20125175

JD51 Distribution unit (P/N 20126827)

JD51 provides solid state switching of two independent sets of directional valve solenoids, 110V DC, 1A.

The unit includes the following circuit boards:

- J50 Power Board ..... P/N 20212528
- J50 Main Board ..... P/N 20211918
- D9X Solid State Board, 110VDC (2 pcs.) .. P/N 20125423

JD52 Distribution unit (P/N 20126835)

JD52 provides solid state switching of two independent sets of directional valve solenoids, 110/220V AC, 1A.

The unit includes the following circuit boards:

- J50 Power Board ..... P/N 20212528
- J50 Main Board ..... P/N 20211918
- D9X Solid State Board, 110/220V AC (2 pcs.) P/N 20125720

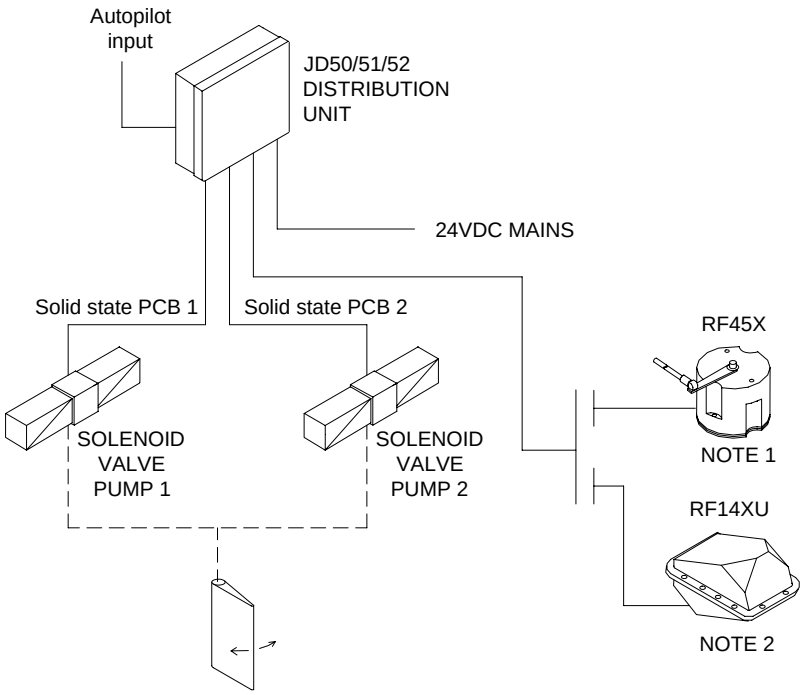


Figure 2-9 AP50 system with ON-OFF valves

Note 1: RF45X: No limit switches, current output for rudder angle indicator(s)

Note 2: RF14XU: Limit switches included, voltage (output) for rudder angle indicator(s)

JD53 Distribution unit (P/N 20126843)

JD53 provides two galvanic isolated output control signals of ±10V DC and 4-20 mA or a control signal that can be adjusted within a certain range of an input reference voltage (ref. section 4 for details).

The unit includes the following circuit boards:

- J50 Power Board..... P/N 20212528
- J50 Main Board ..... P/N 20211918
- JD5X Dual Analog Board..... P/N 20214292

Note! *No autopilot feedback unit is required.*

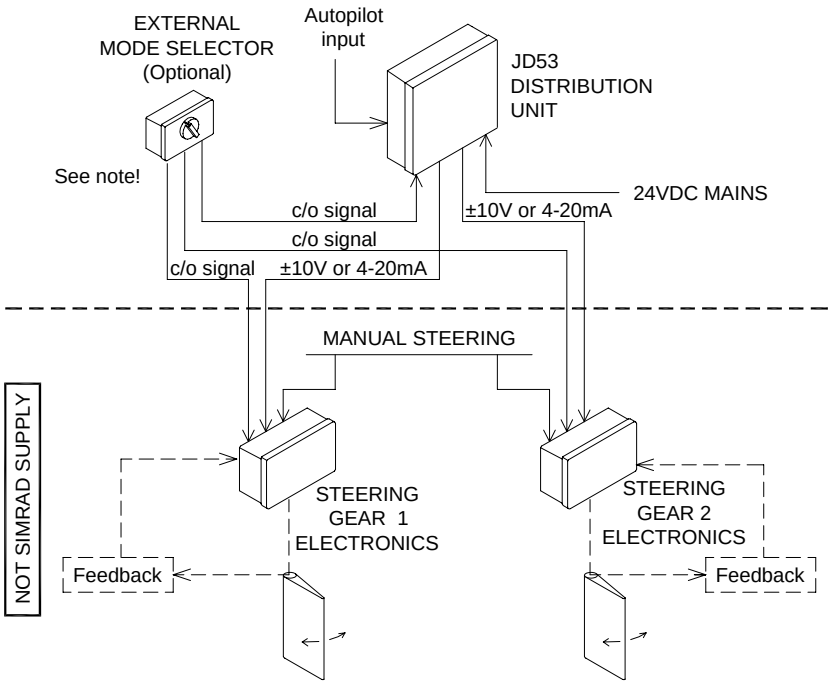


Figure 2-10 AP50 system with Dual Analog output

Note! *Check with steering gear system if switches for control of autopilot auto mode are included. If so, refer to drawing of External Mode Selector (Figure 2-21).*

Mounting

JD5X distribution units are designed to operate in a location that provides ambient temperatures below +55°C (+130°F). The distribution units are not waterproof and should be mounted vertically.

The unit has 4 screw holes for mounting, and should be placed as near the Control Unit as practical. It can also be mounted inside a console.

Electrical connections

General

The standard mains supply is 24 VDC. For AC mains connection an AC adapter rated at 24VDC 1,5A must be connected between the mains source and the distribution unit (not standard scope of supply).

Depending on type of distribution unit, the solid state relays are capable of operating solenoids for high and low DC or AC. Analog voltage or current output is also available for steering gears that require analog input signals.

Grounding and Radio Frequency Interface (RFI)

The AP50 system has excellent Radio Frequency Interference (RFI) protection and all units use the distribution unit as a common ground/shield connection. The distribution unit has an external ground terminal and must have a proper ground connection to ships hull. The grounding wire should be as short as possible and at least 10 mm wide (screen from coax cable or similar).

Robnet cables and other signal cables (i.e. compass, feedback, NMEA) should not be run in parallel with other cables carrying radio frequency or high current, such as VHF and SSB transmitters, battery chargers/generators, and winches.

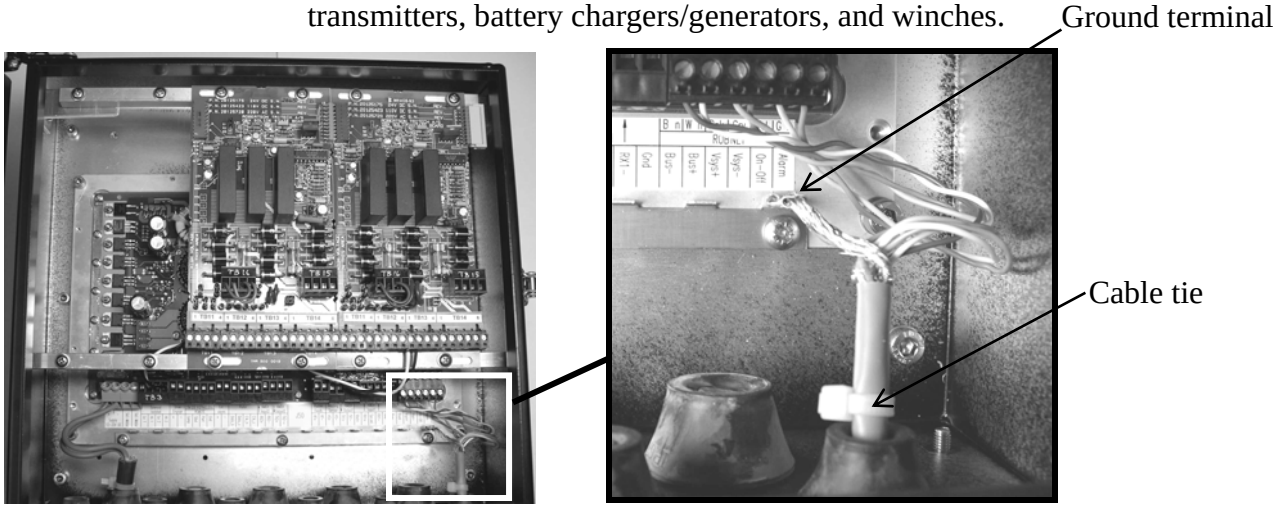


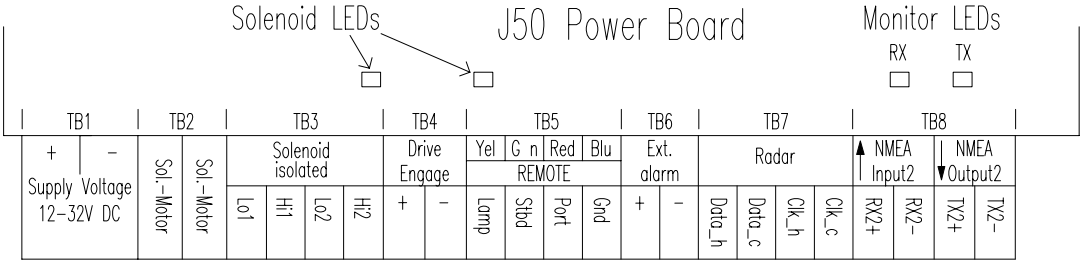
Figure 2-11 JD5X Distribution Units Screen Termination

The plug-in terminals are located at the bottom of the cabinet.

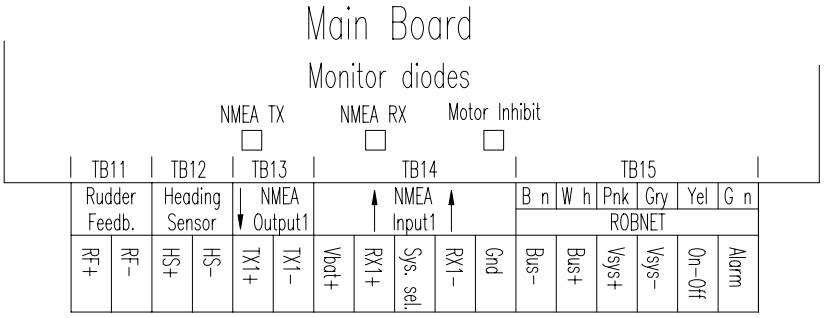
Insert the cable through an appropriate cable gland. Strip of the cable insulation. Provide sufficient wire length so that the plug-in terminals can be easily connected and disconnected.

Pull out each terminal before connecting the wires. Be careful not to drop screen cuts inside the cabinet. Connect the wires to the terminal. Crimp the supplied Faston terminal to the screen and connect to the grounding plug-in terminal. Secure the cable by using the supplied cable ties (See Figure 2-11).

Distribution Unit Terminals



Power Board Terminals



Main Board Terminals

Steering gear with directional valves (ON/OFF)

Three versions of JD5X are available for connection to steering gears with two sets of directional valve solenoids.

- JD50 is used for steering gears with 19-40V DC solenoid supply
- JD51 is used for steering gears with 110V DC solenoid supply
- JD52 is used for steering gears with 110/220V AC solenoid supply

Each of the solenoid switching versions includes two identical Solid State Boards. The Solid State Boards for the different versions are made from the same board but components related to the solid state "relays" are different. However, the connection is identical and the solenoid steering gear should be connected to the Solid State Board according to the following diagram. Use screened cable of 0.5 mm^2 (AWG20), twisted pair.

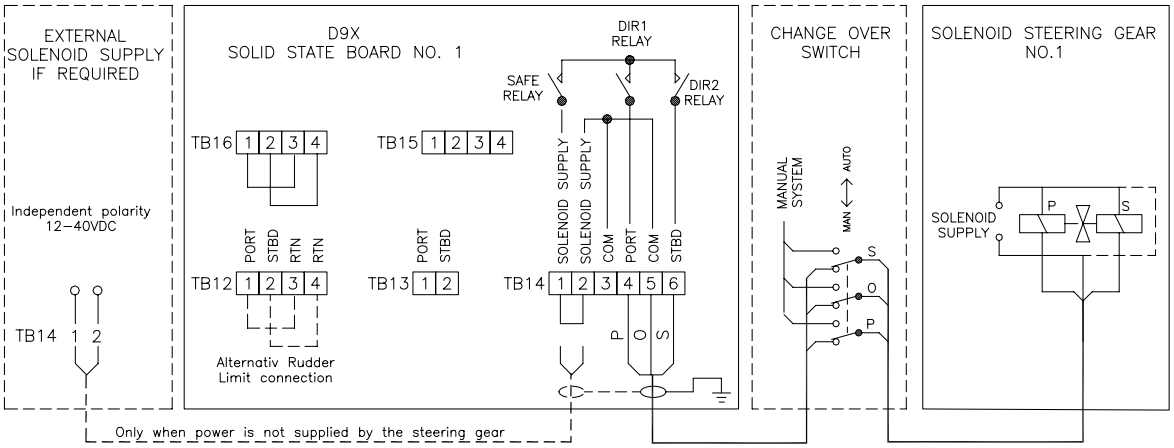


Figure 2-12 Solenoid steering gear connection

Note! *Remove the jumper between TB14, 1 and 2 when external solenoid supply is used.*

Change-Over Switch

A Change-Over (C/O) switch may be required to isolate the autopilot system from the steering gear system. This switch is normally included as part of the steering gear system. The switch may also be combined with mode selection of the autopilot (ref. System Select).

In most cases a Manual/Autopilot Change-Over switch will be included in the steering gear bridge panel. This is normally a potential free galvanic isolated contact that can be used to toggle the autopilot between Auto/NFU. See Figure 2-13 for connections.

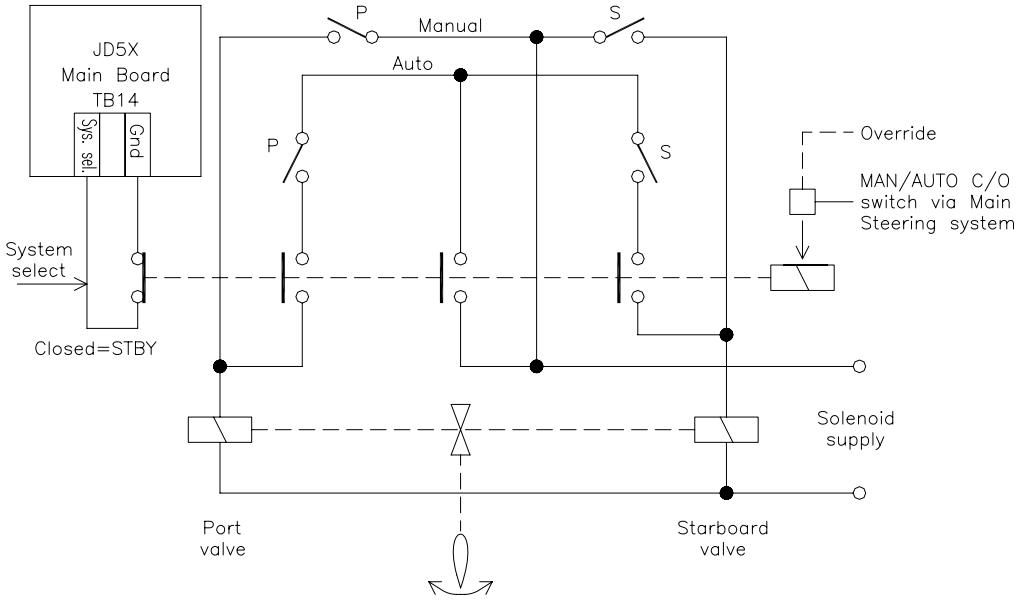


Figure 2-13 Manual/Autopilot Change-Over switch

Eventually a separate Change-Over switch Man-Auto may be required if not included in the steering system, in order to disconnect the autopilot and hence avoid an uncontrolled hard-over rudder movement in the event of an autopilot failure.

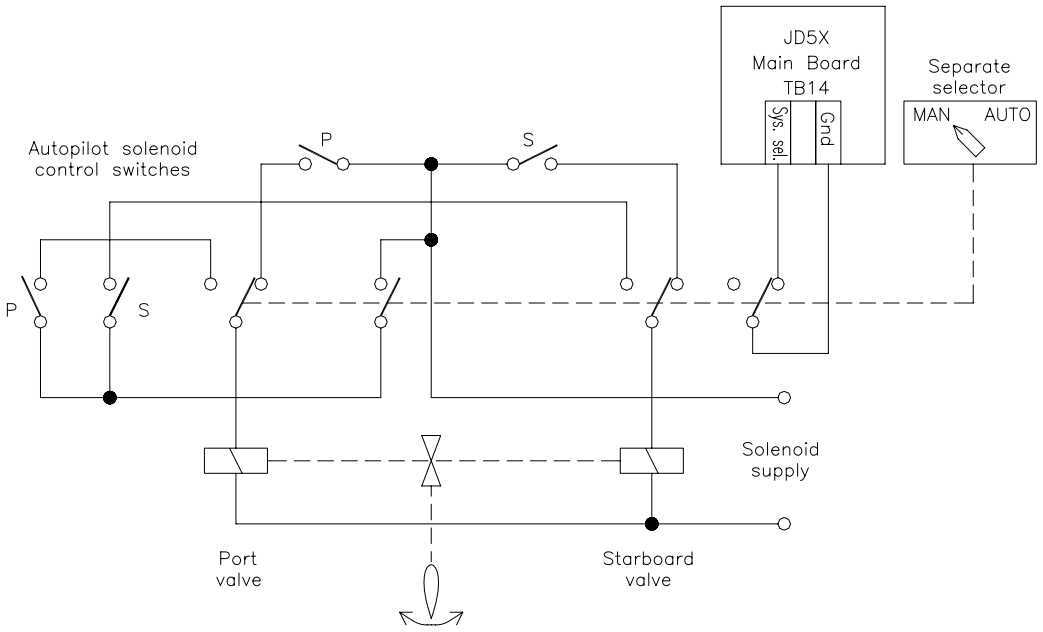


Figure 2-14 Separate Change-Over switch

D9X Solid State Board

The D9X Solid State Board is designed for connection to limit switches. Normally each set of solenoids (Port – stbd.) will have one set of limit switches, and the RF14XU Feedback Unit includes two individual set of limit switches.

Figure 2-15 shows a simplified functional diagram of the D9X Solid State Board. There are two options for connection of limit switches, either at TB16 or at TB12. On TB12 the limit switches determine the on-off function of the optocouplers IC4-A and IC4-B and hence represent minimum load and corresponding voltage drop along the cables to the feedback unit. On TB16 the limit switches and cables carry the full load of the solenoids and may represent a critical voltage drop.

If no limit switches are required, make sure the terminals are jumpered as shown on Figure 2-12.

Several LEDs are mounted on the board for easy identification of status. Refer to the component layout on Figure 2-16.

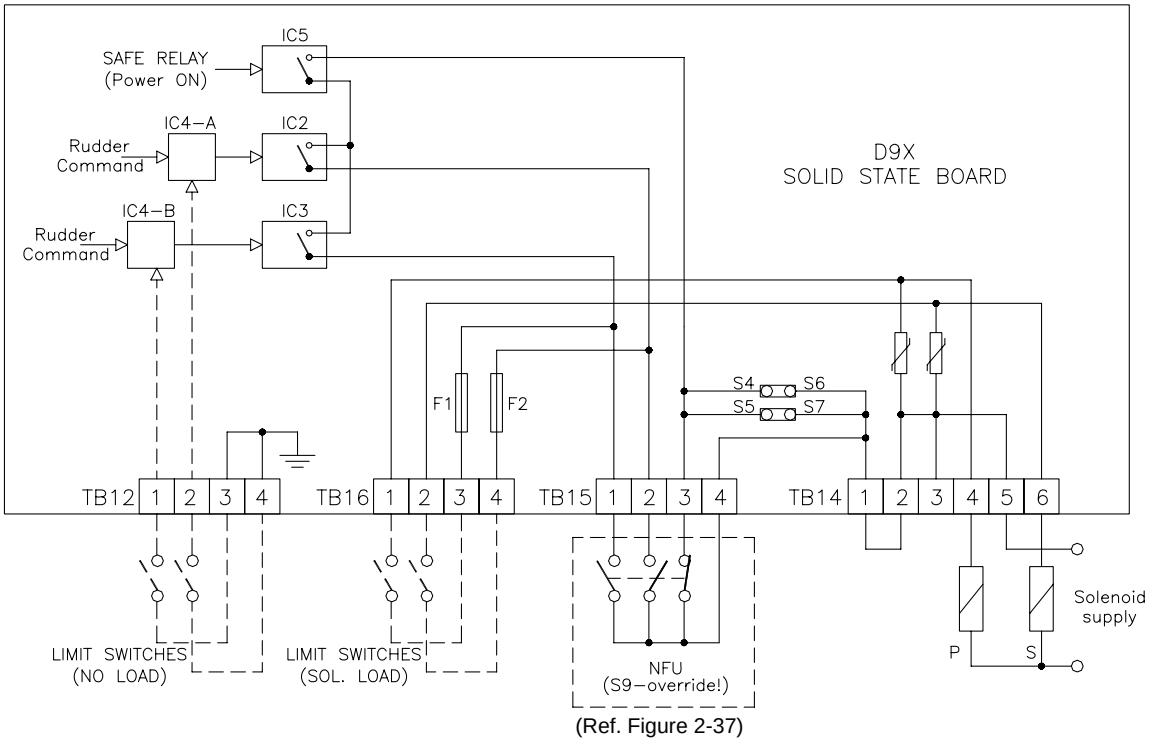


Figure 2-15 Solid State Board – Functional Diagram

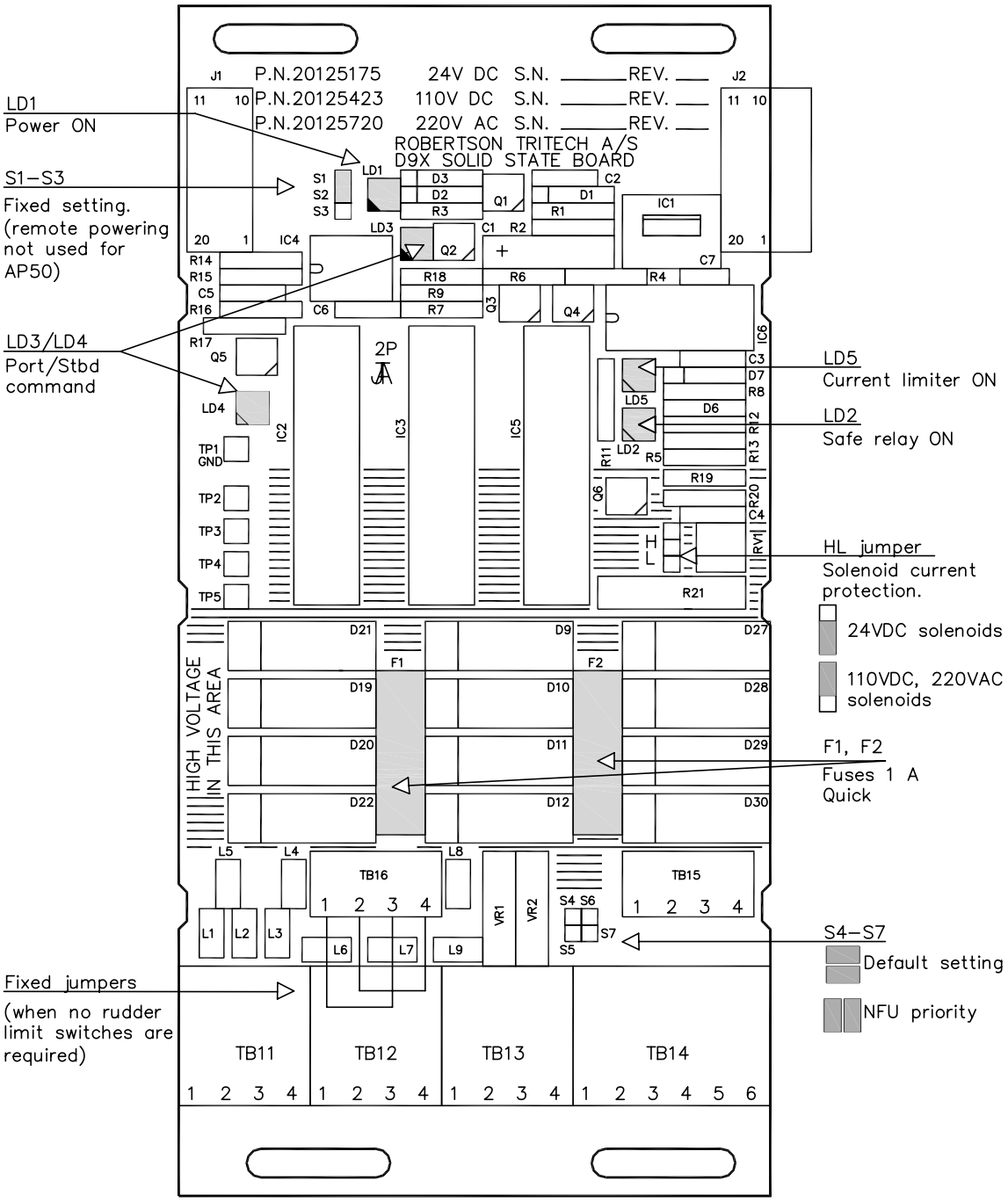


Figure 2-16 D9X Solid State Board, component layout

Analog Steering gear control

The JD53 Distribution Unit provides dual analog control of rudder(s) in an AP50 system by either continuous voltage or current signal.

The following description shows how to connect the various analog control signals of JD53 to the steering gears.

Signal level and polarity are adjusted from the AP50 Control Unit (Ref. AP50 Autopilot Manual, Software Setup Procedure).

Whenever autopilot control is selected, the analog signals will give rudder commands in NFU, FU and AUTO mode. In STBY mode the analog control line will be open (relay contacts located inside JD53). Should the steering gear be of a kind that does not give rudder stop for an open control line when autopilot control is selected, the S5 (ref. Figure 2-22) can be used to keep the control line always closed irrespective of mode and rudder commands. Alternatively the Mode signal can be used to prevent an open line (ref. page 24).

Note ! *Make sure the DIP switch SW1-1 is set to OFF (ref. page 27).*

Galvanic Isolated ±10 V control

The nominal 0±10 VDC control signals are available at TB20 and TB22 terminals 1 and 2, see Figure 2-17. This voltage is galvanic isolated from the operating voltage for the autopilot (24 VDC). Rudder zero voltage and control range can be adjusted in the Dockside setup (ref. page 55).

Note ! *Jumpers S1 – S4 must be set to "INT", ref. Figure 2-22 to identify the jumper locations.*

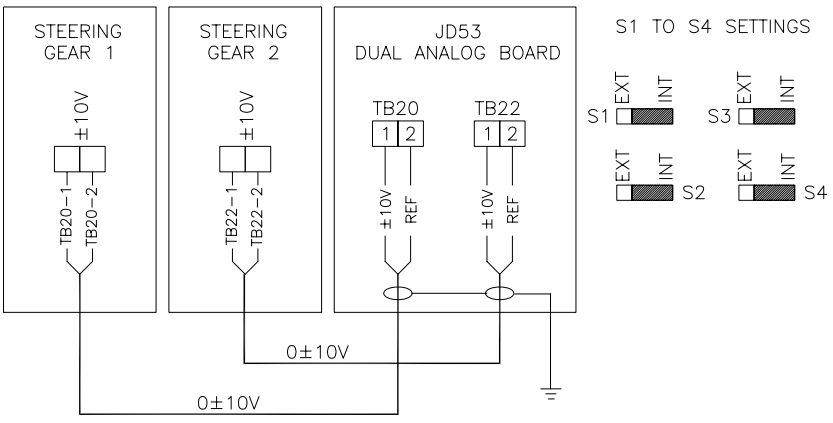


Figure 2-17 Isolated ±10V output

Voltage control with external reference

Figure 2-18 shows how an external reference voltage (12-24V) is wired to the Dual Analog Board TB20 and TB22, terminals 3 and 4. With the external voltage return (terminal 4) as reference the default rudder zero voltage and control range output at terminals 1 and 4 will depend upon the external reference voltage and can be adjusted in the Dockside setup (ref. page 55).

Note ! *Jumpers S1 to S4 must be set to "EXT", ref. Figure 2-22 to identify the jumper locations.*

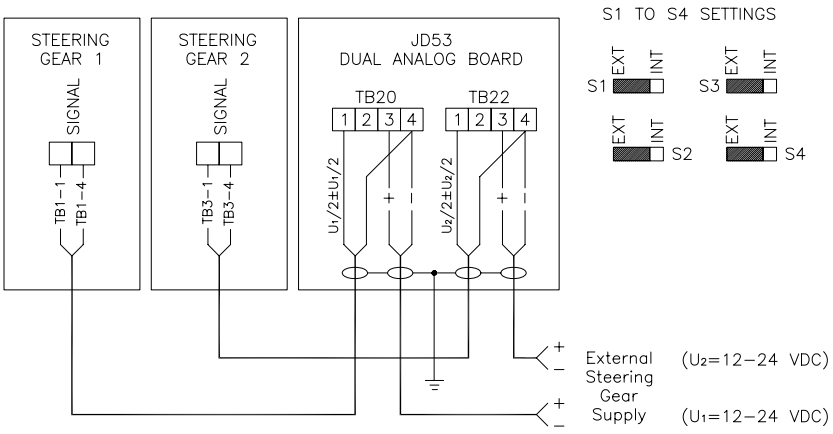


Figure 2-18 Positive variable output, external reference

4 - 20 mA control

A 4-20 mA control signal is available at TB21 and TB23 terminals 1 and 2 as shown in Figure 2-19. Rudder zero current and control range can be adjusted in the Dockside setup (ref. page ref. page 55).

Note ! *Jumpers S1 to S4 must be set to "INT", ref Figure 2-22 and Figure 2-17.*

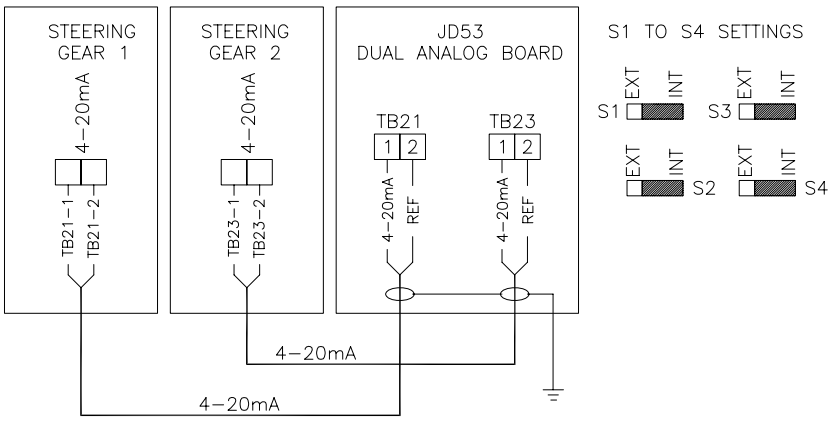


Figure 2-19 4-20 mA Current Control

Mode and Autopilot Status Signals

The JD53 Dual Analog Board is equipped with two sets of relays, providing potential free contacts (ON1 - ON2 and Mode1 – Mode2) as normally open (no) or normally closed (nc). The function is selected via jumper switches S6, S7, S8 and S9.

The closing or open contact at TB24 terminals 1 and 2 and TB26 terminals 1 and 2 (ON1 – ON2) are activated whenever the autopilot is switched on, and may be used in conjunction with “hand-shake” signals between steering gear and autopilot to verify that the autopilot is switched on and “ready” for control of the steering.

The Mode1 and Mode2 contacts are activated in NFU, FU, Auto and Nav modes and can be used to provide change-over of the steering gear from Manual to Autopilot steering. Alternatively the (Mode) changeover can be set to operate only in Auto and Nav (ref. Drive Engage setting in AP50 Installation Manual.

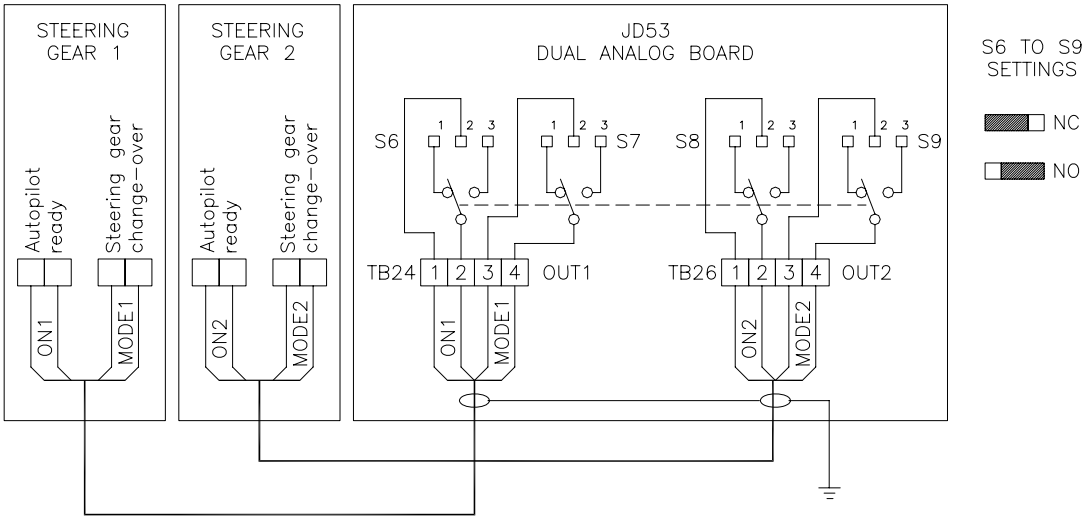


Figure 2-20 Mode and autopilot status

External Mode Selection

The most common signals from a steering gear to an autopilot are shown below.

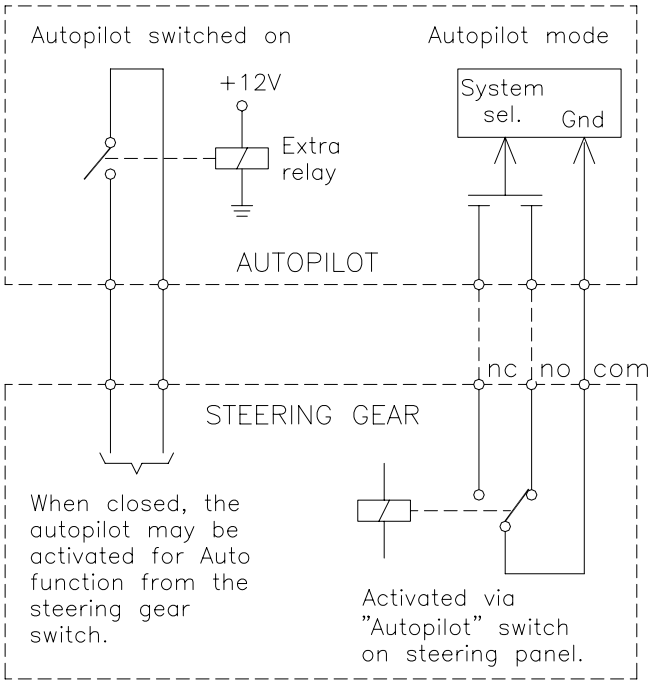


Figure 2-21 External mode selection

Dual Analog Board

Refer to the component layout below to identify LEDs and switches.

Software upgrade is possible by connecting a PC to J3 via a Special programming kit (Simrad P/N 22088595)

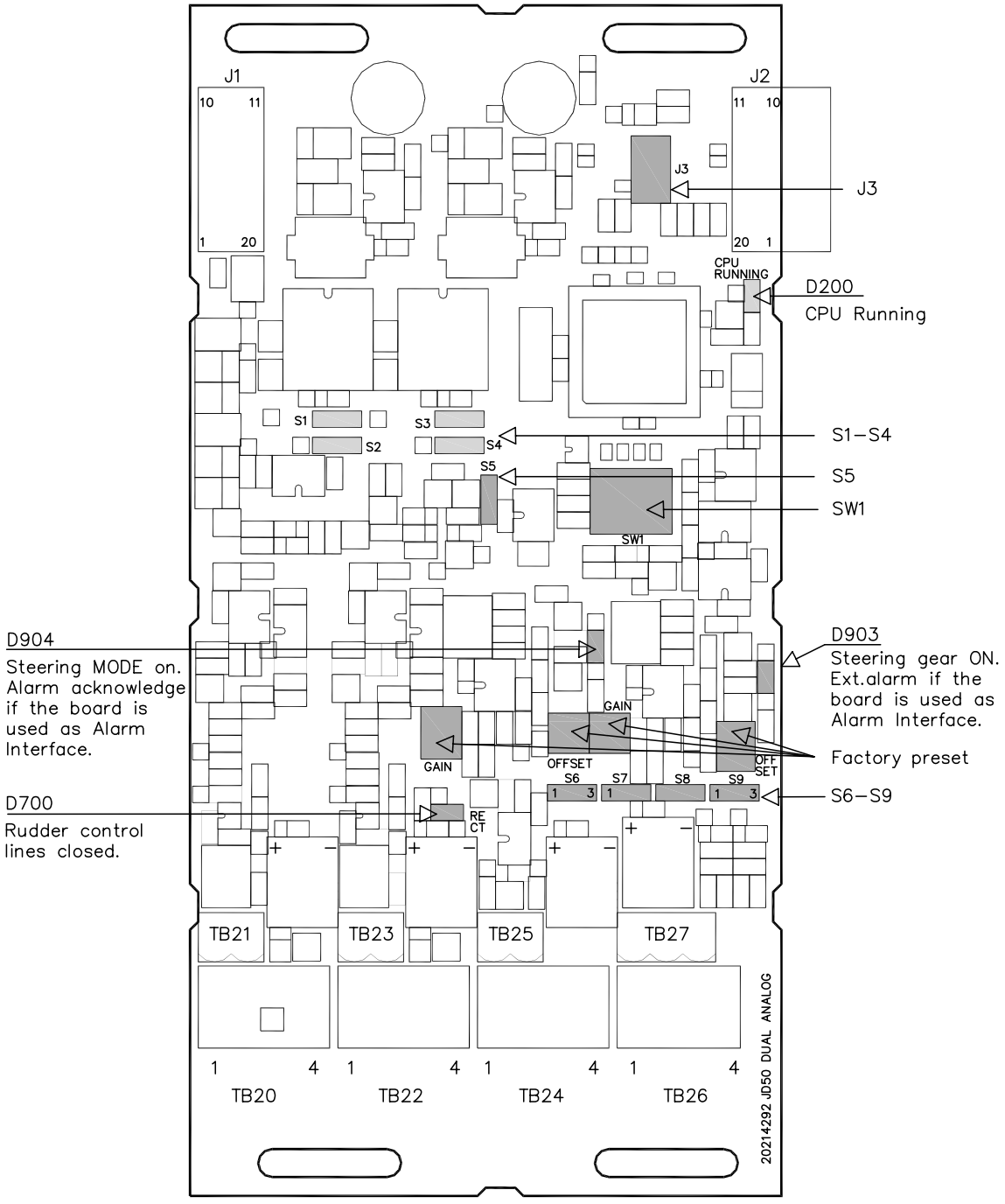


Figure 2-22 JD53 Dual Analog Board, component layout

Installation setting summary:

S1 to S4: External/Internal ref. voltage and voltage/current control (ref. Figure 2-17 to Figure 2-19).

S5: For open/closed or always closed analog signal line(s), ref. page 28.

Always closed

Open /closed depending on system status

CPU RUNNING: Alternating green when JD53 is operative (ref. setting of DIP switch SW1).

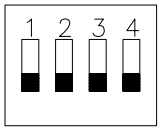
ON: Green when Autopilot ON relay is activated (ref. page 24).

MODE: Green when MODE relay is activated (ref. page 24).

CONTROL Green when control signal lines are closed (ref. page 22).

DIP SWITCH setting

SW1

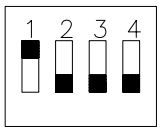


Settings for analog steering

(CPU running alternates at 1 Hz)

Settings for alarm interface

(CPU running alternates at 2 Hz)



For future use

(CPU running alternates at 0.5 Hz)

Other settings (illegal)

(CPU running alternates at 4 Hz)

JD50 Alarm Interface

A Dual Analog Board can, by dip-switch setting, be installed as an Alarm Interface option in any of the JD5X units. This is necessary for the AP50 autopilot system to comply with DNV NAUT OSV class when a direct i/o type central alarm panel is installed.

The board is secured by four mounting screws on the upper mounting bars alongside the steering gear interface board(s) as shown on Figure 2-24. The dip switch SW1-4 must be set to ON and the jumper S5 must be set to “Always closed” (ref. page 27).

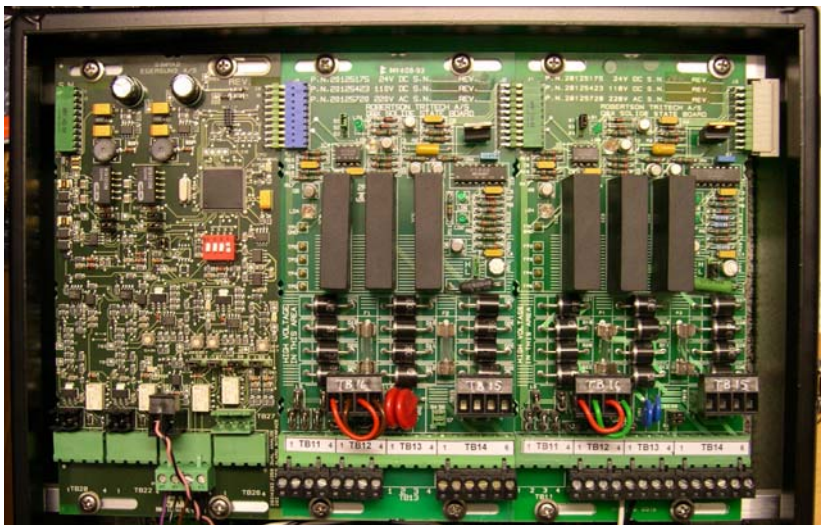


Figure 2-23 JD50 with two Solid State Boards and one Dual Analog board set up as Alarm Interface

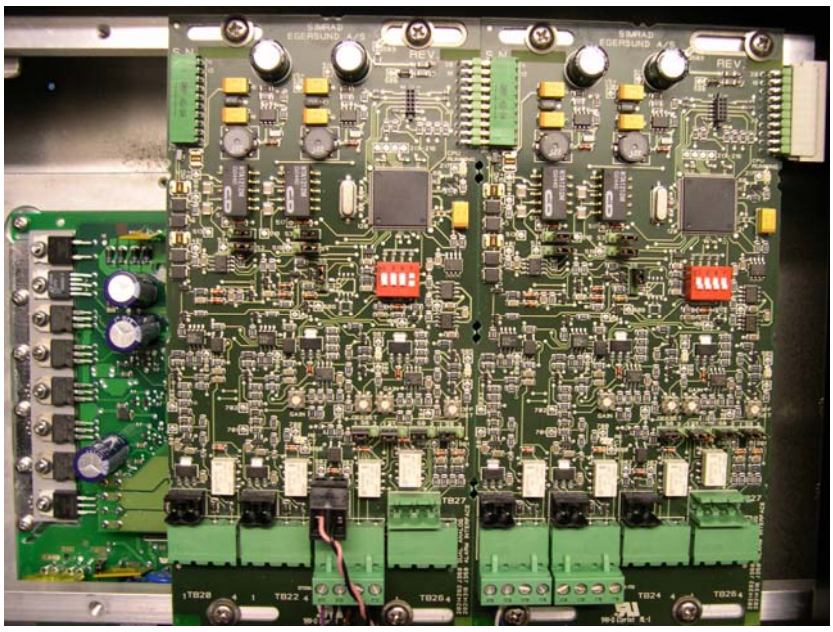


Figure 2-24 JD53 with two Dual Analog Boards – one set up as Alarm Interface

The board will interface to the central alarm panel as shown on Figure 2-25. The ALARM contact will stay activated for as long as an autopilot alarm is present. Upon alarm acknowledge on the autopilot control unit, the ACK OUT contact will be activated for 0.5 sec and the sound from the autopilot system will cease. If ACK IN is received from the central alarm panel, the sound will cease in the autopilot system. The visual alarm on the autopilot will always remain for as long as a fault situation is present.

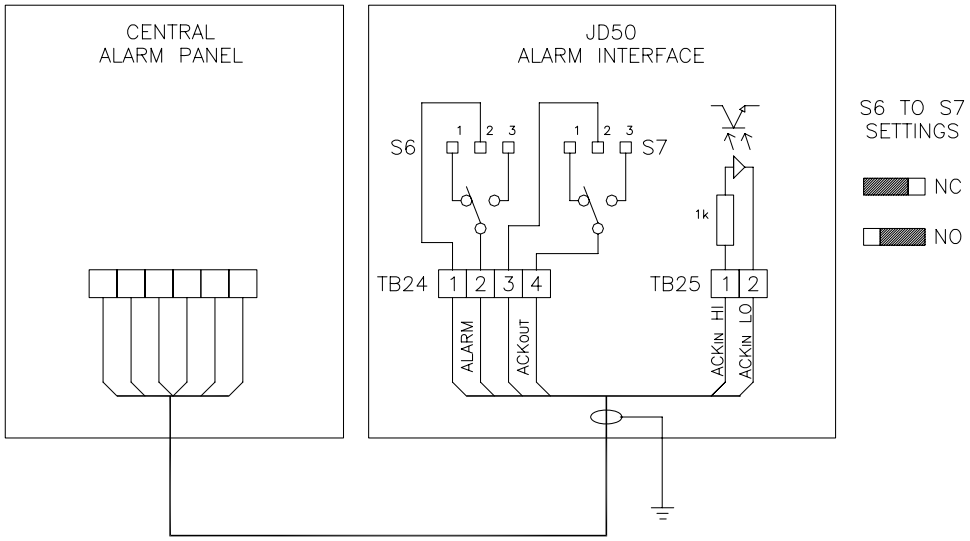


Figure 2-25 Alarm connection

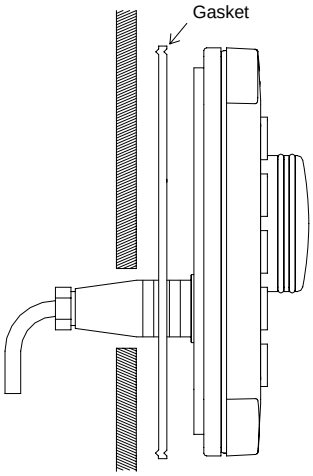
2.9 Control Unit

Avoid mounting the control unit(s) where it is easily exposed to sunlight, as this will shorten the lifetime of the display. If this is not possible, make sure the units are always covered with the protective cover when not in use.

Panel-mounting

The mounting surface must be flat and even to within 0.5 mm.

- Drill the 4 mounting holes and make a panel cutout according to the supplied template.
- Use the supplied gasket between the panel and the unit.
- Use the supplied 19 mm screws to fasten the control unit to the panel.
- Apply the front panel corners.
- Connect the Robnet cable(s) to the control unit connector(s) (see “Note!” on page 33).



Optional Bracket mounting

(This may be ordered separately from Simrad, part no. 20212130).

Note !

When the control unit is bracket-mounted, it is not weatherproof from the back due to a breathing hole in the back cabinet. When bracket-mounted, the exposed parts of the plugs should be protected against salt corrosion.

- Locate the cradle on the mounting site and mark the 4 holes for the screws on the mounting surface.
- Drill the 4 holes and screw the cradle to the mounting surface.
- Use the supplied screws to fasten the control unit to the left and right brackets.
- Apply the front panel corners.
- Use the two locking knobs to assemble the cradle with the left and right brackets and adjust the control head for the best viewing angle.
- Connect the Robnet cable(s) to the control unit connector(s) (see “Note!” on page 33).

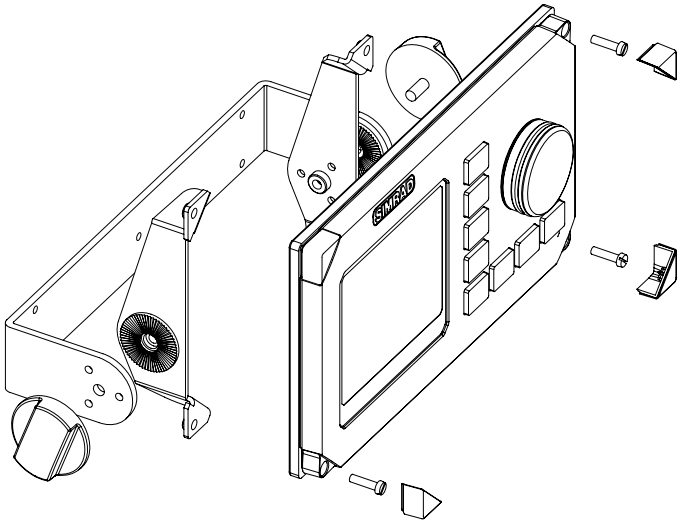


Figure 2-26 AP50 Bracket mounting

Robnet Units and Robnet Network Cables

The following Robnet units are available in a system:

AP50 Control Unit, AP51 Remote Control, RC25 Rate Compass, FU50 Follow-Up lever, GI51 Gyro Interface, NI300X NMEA Interface, TI51 Thruster Interface and AD50 Analog Drive.

As most Robnet units have two Robnet connectors, they can be used for further expansion of the system. There are no dedicated "in" or "out" connectors. You may connect the cables to any available Robnet connector on the specific unit.

The Robnet cables are available in 7 and 15 m lengths and they contain a 6-pin male connector at one or both ends. The 15 m cable to the junction unit has a connector only at the control unit end.

Additional extension cable (10 m) with a male and a female connector, is available from Simrad (part no. 22192266).

When installing a system, try to minimize the total Robnet cable length by connecting all Robnet units to the nearest available Robnet connector.

The total length of Robnet cables depends on the number of Robnet units and the voltage drop across the connected units.

Use the following table as a guideline.

Number of Robnet units	Maximum cable length in m (feet)
1	390 (1270’)
2	195 (640’)
3	130 (425’)
4	95 (310’)
5	75 (245’)
6	65 (210’)
7	55 (180’)
8	50 (165’)
9	45 (150’)
10	40 (130’)

If the total length exceeds the recommended length, please contact your Simrad distributor on how to arrange the system to minimize the voltage drop.

Examples of interconnecting Robnet units:

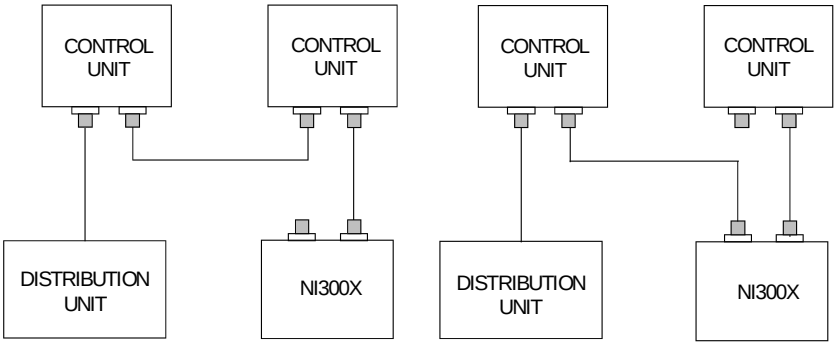


Figure 2-27 Interconnecting Robnet Units

All connectors are crimp-type and can be easily disassembled if desired for ease of installation (see Figure 2-28).

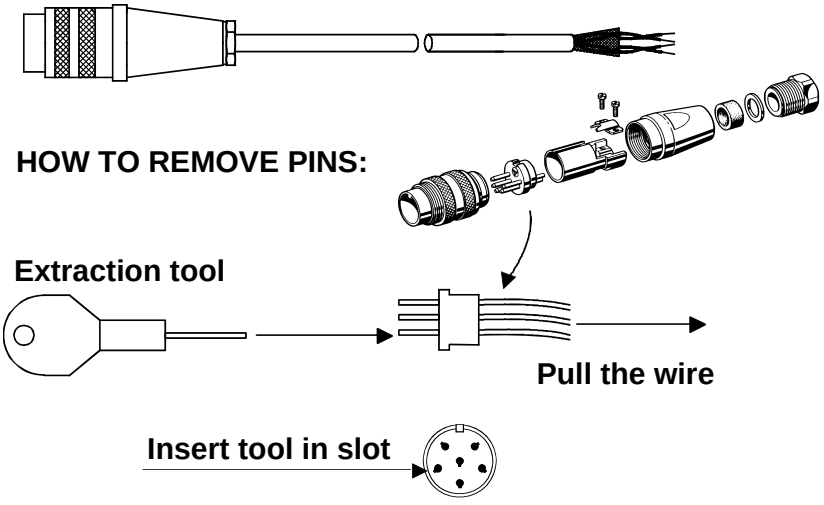
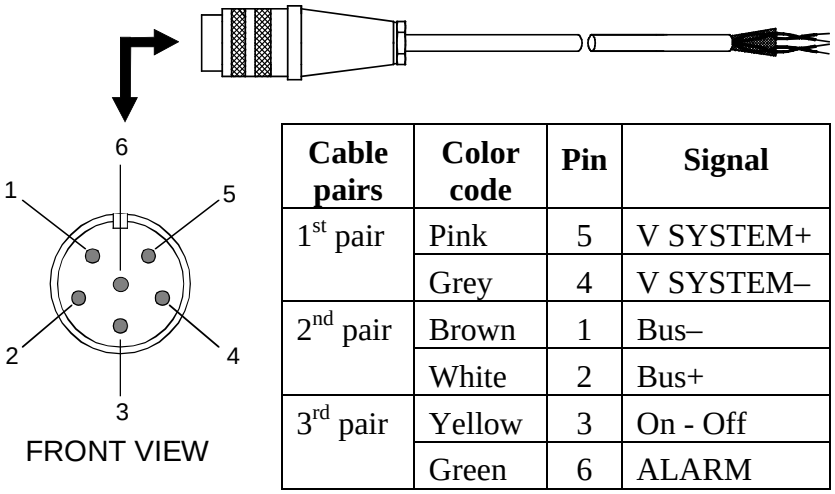


Figure 2-28 Removing Pin

See Table 2-1 for pin configuration and color code of the network cable. DO NOT MIX THE PINS AND THE CABLE COLORS!

Note !

Apply a thin layer of pure Vaseline (petroleum jelly) on the connector threads and make sure the connectors are properly secured to the receptacle by the coupling ring. When properly installed, the connectors are weatherproof according to IP56. All unused Robnet plugs must be fitted with plastic caps to keep the connectors free of dirt and moisture. A separate screw cap for the control unit is included in the installation kit.



Cable pairs	Color code	Pin	Signal
1st pair	Pink	5	V SYSTEM+
	Grey	4	V SYSTEM–
2nd pair	Brown	1	Bus–
	White	2	Bus+
3rd pair	Yellow	3	On - Off
	Green	6	ALARM

Table 2-1 Robnet Plug Pin Configuration

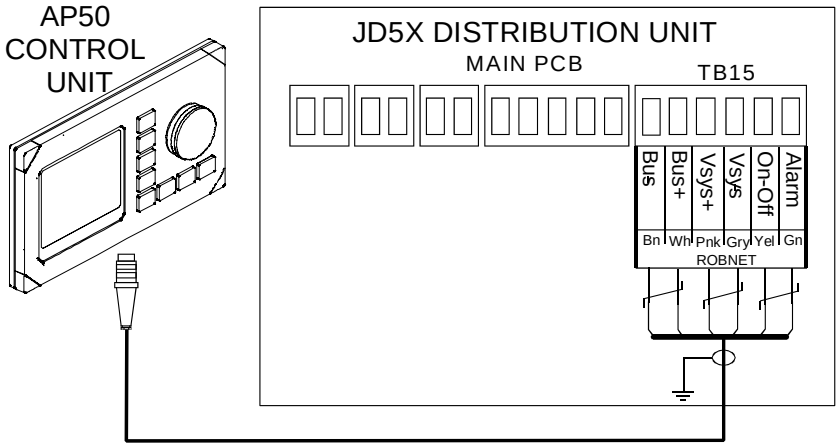


Figure 2-29 Control Unit Connection

Note !

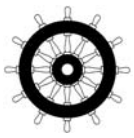
For installations that require special cable lengths, contact your Simrad distributor for information.

AP51 Remote Control Connection

If the AP51 Remote Control is part of the system, use the Robnet connector in a free receptacle (see Figure 2-27). Alternatively, cut the connector from the cable and connect the wires in parallel with the cable shown on Figure 2-29 using the same color code.

Note ! *The AP51 cable contains a ventilation tube. Check that the tube is open after you have cut the cable.*

AP51 in a Wheelmark System

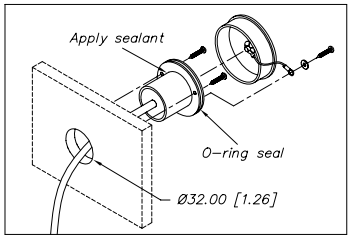


In a Wheelmark system, only the Master Unit may turn the system off. To ensure that the system cannot be switched on or off from the AP51 Remote Control Unit, the yellow wire in the AP51 cable must be cut or not connected. Open the Robnet connector (see Figure 2-28). Remove pin 3 (yellow wire) and cut it off at the end of the wire. Insulate the wire and push it back in the pin 3 slot. Reassemble the Robnet connector.

JP21 Jack Point Installation

The JP21 Jack Point can be used in conjunction with the AP51 Remote Control Unit.

It provides a quick and simple means of connection and disconnection of the AP51 at different locations on the boat.



The JP21 includes a watertight connector cover that must be installed as shown below. A 32 mm (1.26 inch diameter) hole must be drilled for flush installation, along with 3 small screw holes. As indicated, a watertight sealant must be applied to the mating surfaces of the JP21 and the mounting panel. Apply a thin layer of Vaseline to the O-ring seal.

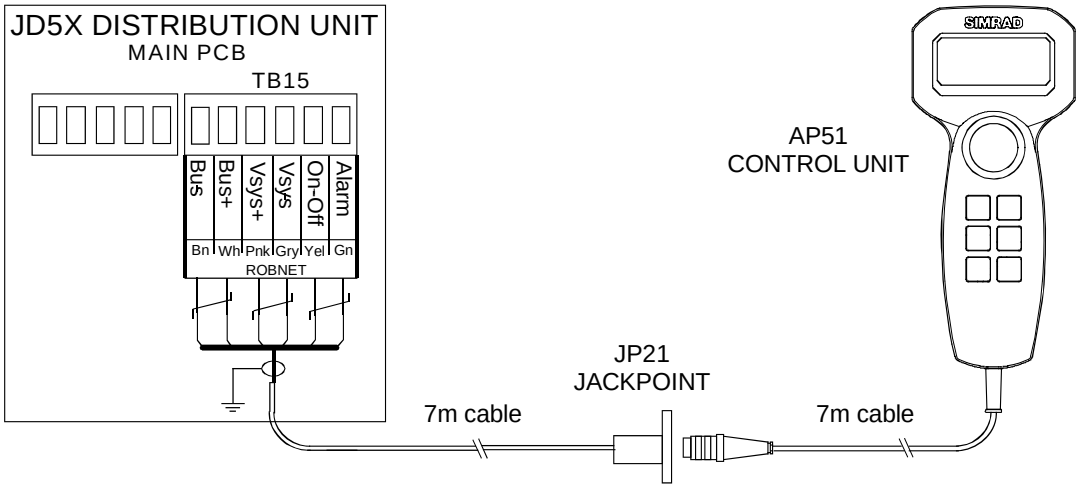


Figure 2-30 JP21 Jack Point Mounting

2.10 RC25 Rate Compass

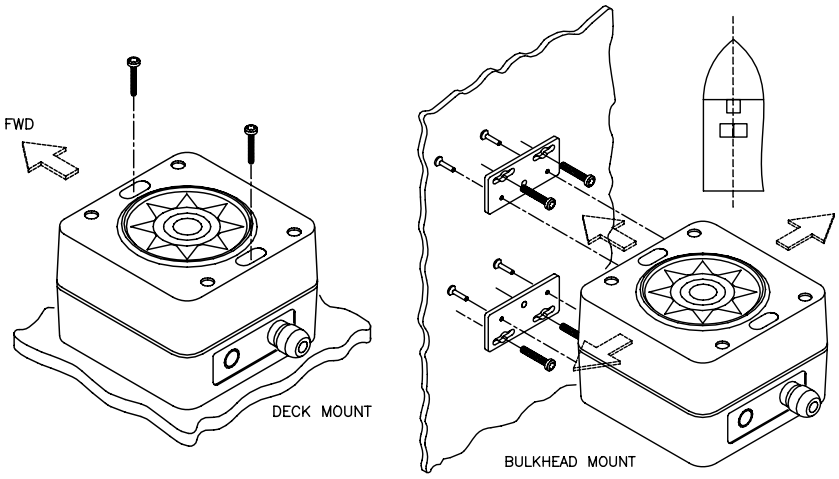


Figure 2-31 RC25 Rate Compass Mounting

The heading sensor is the most important part of the AP50 system and great care must be taken in choosing the mounting location. The heading sensor can be mounted at any location where there is a minimum of magnetic interference and minimum movements. It is not recommended to use the RC25 on steel vessels. However, if this is done, it should be installed 1 meter above the steel deck to obtain optimum performance.

Note !

In order to prevent excessive movements, an autopilot heading sensor should not be installed on the fly bridge or on the mast.

The rate compass can be deck-mounted or on the bulkhead, athwartship or alongship. The heading offset feature of the AP50 will compensate for the mechanical offsets that may be a result of the selected location and orientation of the RC25.

If the compass is deck-mounted or bulkhead-mounted athwartship with the cable gland pointing aft, little if any offset correction is required. When the cable gland points forward, a 180° correction is required.

When mounting the compass on a bulkhead alongship, a +90° or -90° correction is needed, dependent on whether it is a port or starboard bulkhead.

Select a location that provides a solid mounting place free from vibration as close to the vessel's center of roll and pitch as possible (i.e. close to the water line). It should be as far as possible from disturbing magnetic influences, such as the engines (minimum of 2 m), the engine ignition cables, the air-conditioning, any refrigerators, other large metal objects, and particularly the drive unit.

Use the supplied mounting kit and drill the holes through the center of the slots in the sensor or the mounting brackets.

Note ! *The compass faceplate on the rate compass is the TOP. NEVER mount it upside down! Level the sensor as close to horizontal as possible.*

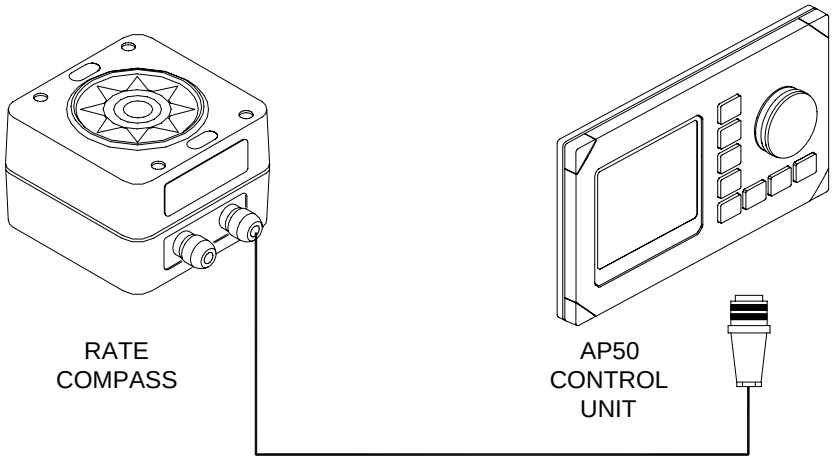


Figure 2-32 RC25 Connection to AP50 Control Unit

- Connect the Robnet connector to the AP50 Control Unit (or GI51 or NI300X if installed).
- Alternatively, if there is no free receptacle, cut the connector from the cable and connect the wires in parallel with the wires going from the distribution unit to the control unit. *Do not connect the yellow and the green wires and ensure that they do not connect with the terminal or chassis.*

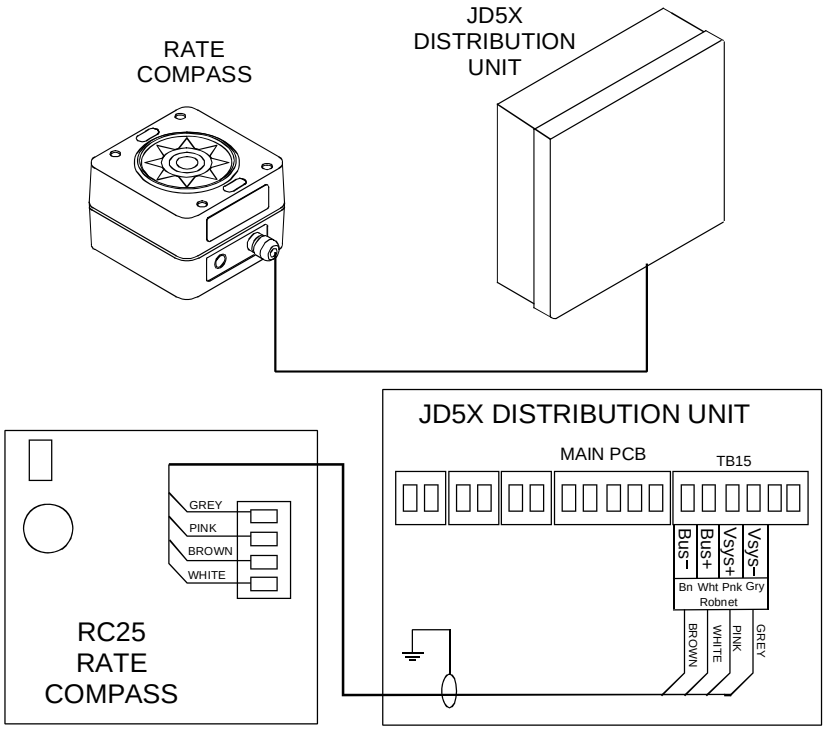


Figure 2-33 Alternative Connection to JD5X Distribution Unit Robnet Terminal

- Change in the Installation Interface menu: Select FLUX = ROBNET.
- Select FLUX as compass in the User Set-up Menu to activate the RC25 as the steering compass.
- Perform the compass calibration as described on page 67.

Note ! *After turning on, the compass will stabilize in less than 30 seconds, but it will need another 10 minutes to fully utilize information from the rate sensor.*

Refer to Compass Offset on page 68 to compensate for any permanent offset after the calibration is completed.

Calibration data is stored in the compass and will not be deleted by a Master Reset in the autopilot. However, offset compensation must be reset.

2.11 FU50 Steering Lever

For connection of the FU50 Steering Lever, see the FU50 manual.

2.12 TI51 Thruster Interface

The TI51 Thruster Interface is designed to provide control signal for operating one thruster in an AP50 system by either on/off solenoid, continuous control, or Sauer Danfoss PVEM valve.

Refer to separate manual for the TI51 Thruster Interface.

2.13 S9 Steering Lever

Mounting

Refer to Figure 2-34. For bulkhead mounting, use the 8 bushings enclosed with the unit. These are placed two and two against each other and the screws are put through them. Direct contact between S9 and a steel bulkhead is then avoided and corrosion is prevented. The cover plate can be turned 360 degrees for the most convenient position of cable outlet. For panel mounting use the two mounting brackets enclosed with the unit (Figure 2-35).

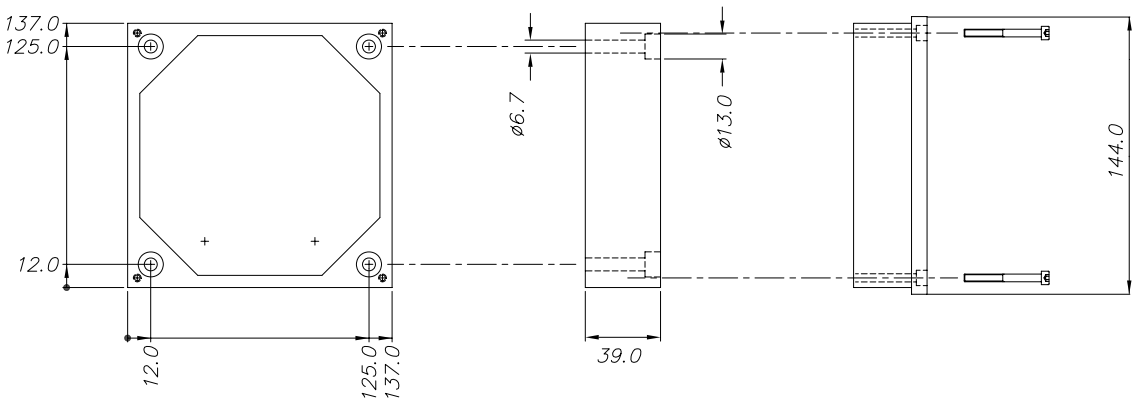


Figure 2-34 S9 Steering Lever, bulkhead mounting

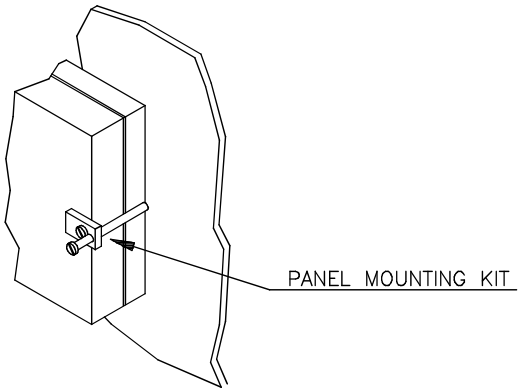


Figure 2-35 S9 Steering Lever, panel mounting

Connection

If connected according to Figure 2-36, S9 can be used for NFU steering through JD5X distribution units when the autopilot is in STBY mode and for course change in AUTO mode.

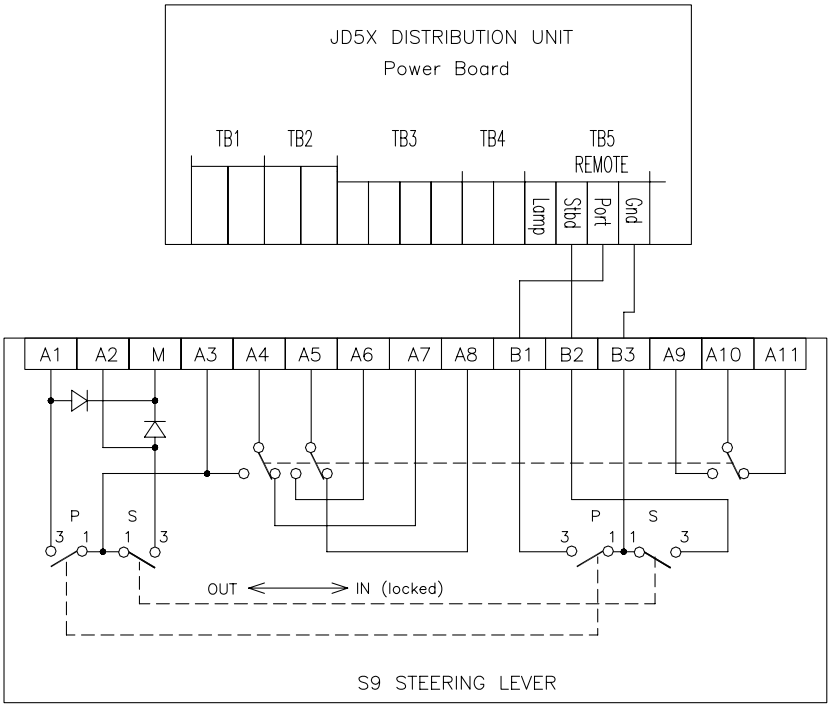


Figure 2-36 S9 connection to JD5X

Priority steering by S9 Steering Lever

The illustration shows one example of arranging an override steering function by the S9 Steering Lever when connected to JD53 Distribution Unit.

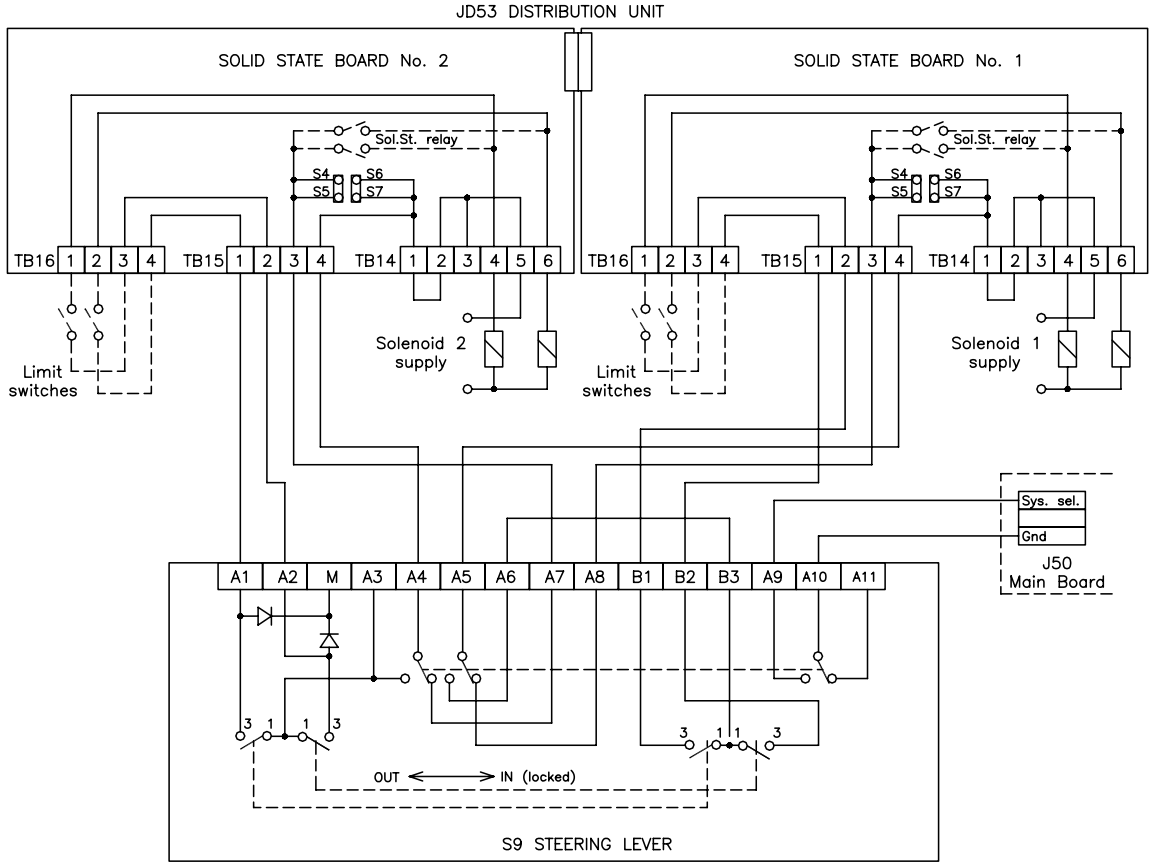


Figure 2-37 Priority steering by S9

Notes !

1. *Make sure the S9 is within the rated specifications for the valves.*
2. *S4-S7 on the Solid State Board must be set for NFU priority. See Figure 2-16.*

When the S9 handle is pulled out, the autopilot will be disengaged. The Solid State PCB is disconnected and the valves are operated only from the S9. When the S9 handle is pushed in, the autopilot will resume in AUTO mode on the present heading.

2.14 R3000X Remote Control

The R3000X Remote Control is weather proof and can be mounted outdoors in the supplied bracket that is fixed by four mounting screws.

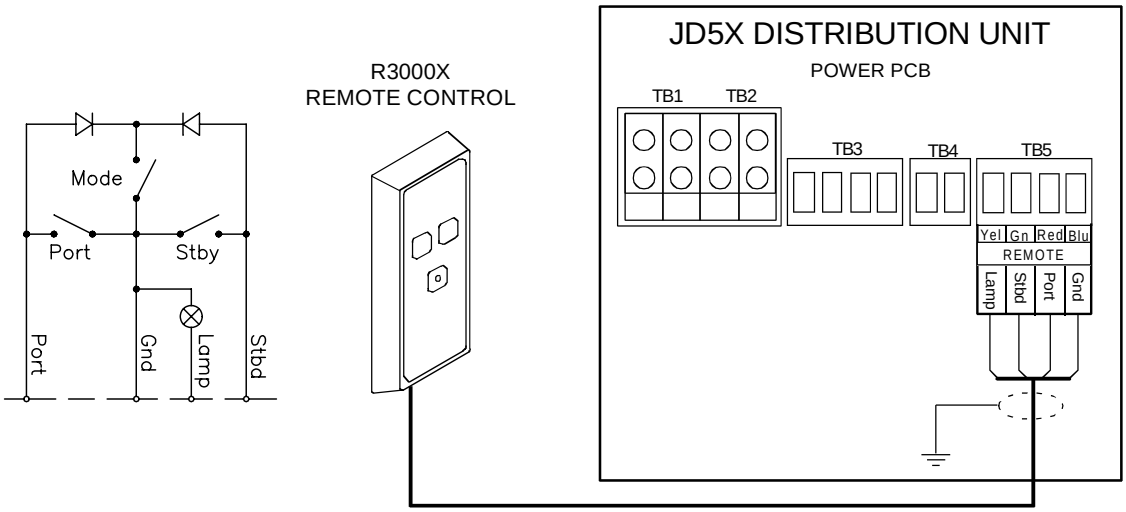


Figure 2-38 R3000X Remote Control Connection

2.15 JS10 Joystick

Refer to separate installation procedure for JS10 (document no. 20221610)

2.16 S35 NFU Steering Lever

The S35 NFU Steering Lever may be mounted to the bulkhead or to a panel by two screws from the front. The cable is connected to the junction unit according to Figure 2-39. If necessary, interchange the Port and Stbd wires to the screw terminals in the junction unit to make the direction of the lever movement coincide with the direction of the rudder movement.

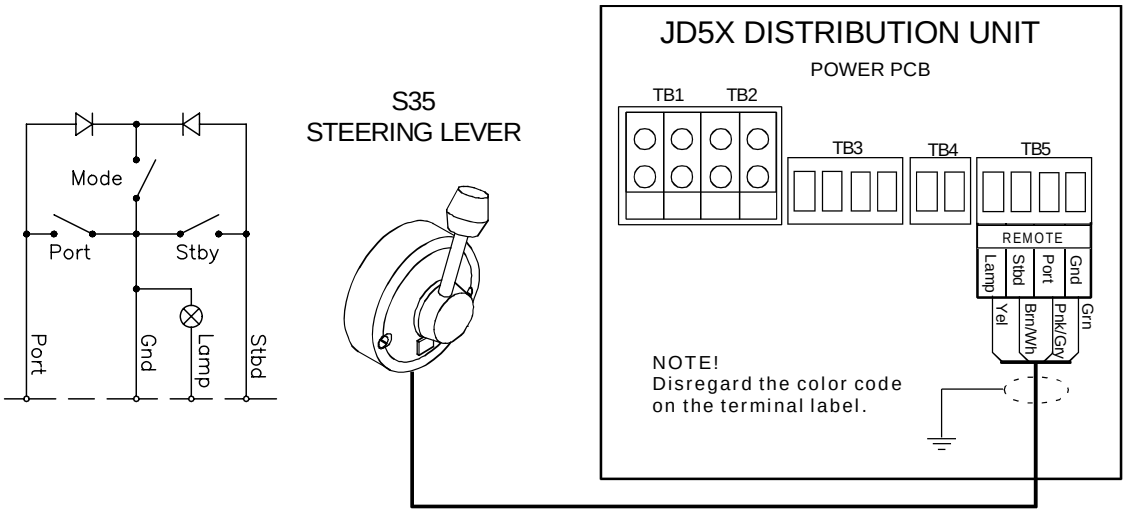


Figure 2-39 S35 NFU Steering Lever Connection to Distribution Unit

The steering lever is opened by removing the three screws on the back cover. Inside are two sets of micro-switches, a printed circuit board with a plug-in terminal, and a jumper strap.

2.17 F1/2 Remote Control

The F1/2 Remote Control comes with 10 m (33 ft.) of cable and is connected to the distribution unit as shown in Figure 2-40.

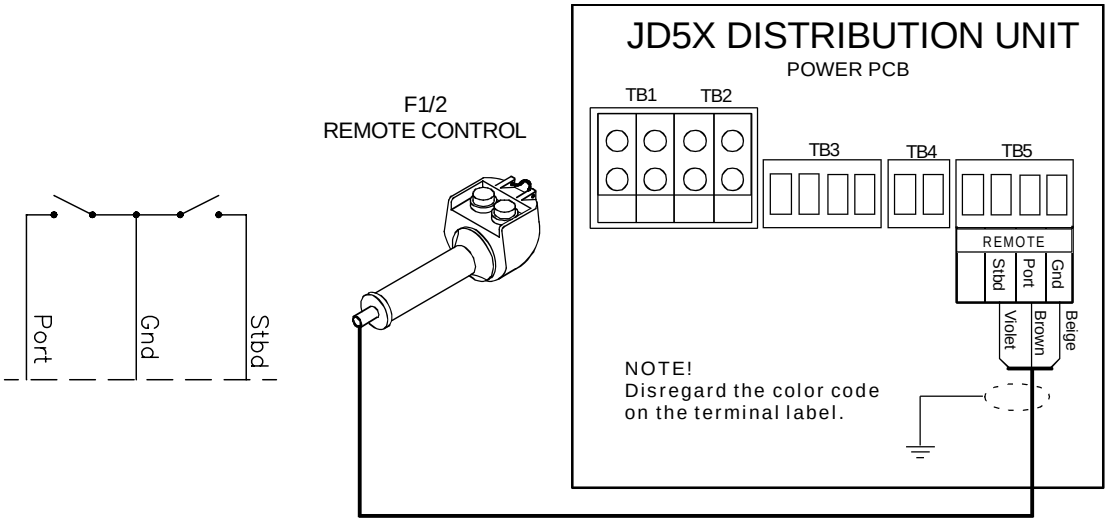


Figure 2-40 F1/2 Remote Control Connection

2.18 Interfacing to Optional Equipment (THD, Navigation Receiver, etc.)

With the AP50 autopilot system, there are several options for connection to other equipment for data exchange:

1. The JD5X distribution units include two NMEA input/output ports and a Clock Data heading interface to Simrad and Furuno radars. Only the J50-2 port (NMEA input 2) accepts NMEA heading sentences.
2. The optional NI300X NMEA Interface (expansion) Unit includes 4 additional NMEA input/output ports.

The following connecting diagrams illustrate the interfacing possibilities.

Note ! *See also "Interface Set-up" page 59 and the NMEA sentence table page 112.*

Single NMEA input/output

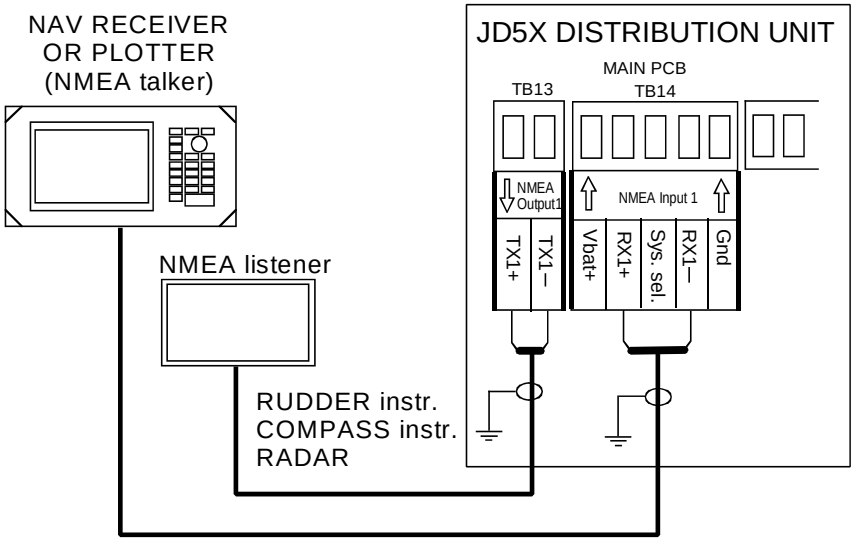


Figure 2-41 Single NMEA Connection

Double NMEA input/output

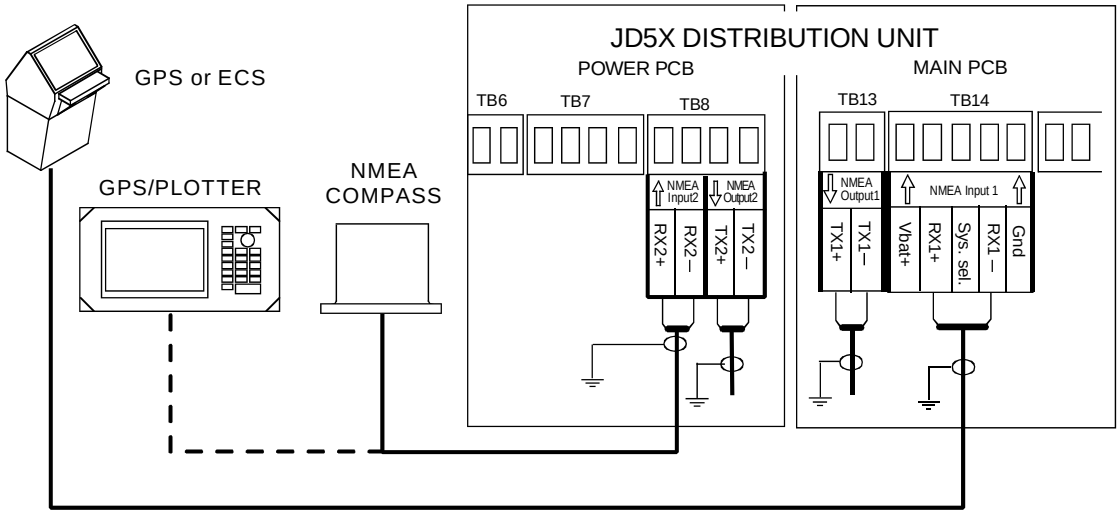


Figure 2-42 Double NMEA Connection

Output signal	Output terminal	Output sentence
Continuous output of 10 Hz NMEA compass heading	Junction unit, Power PCB, NMEA2, TX2+, TX2–	HDT or HDG (steering compass dependent; ref. to the NMEA table)

Table 2-2 Permanent NMEA Output on Port 2

Input from "NMEA Compass"

A gyro compass or GPS compass (or other) with NMEA 0183 HDT (or HDG, HDM message) is connected to the JD5X Distribution Unit NMEA Input2 terminal.

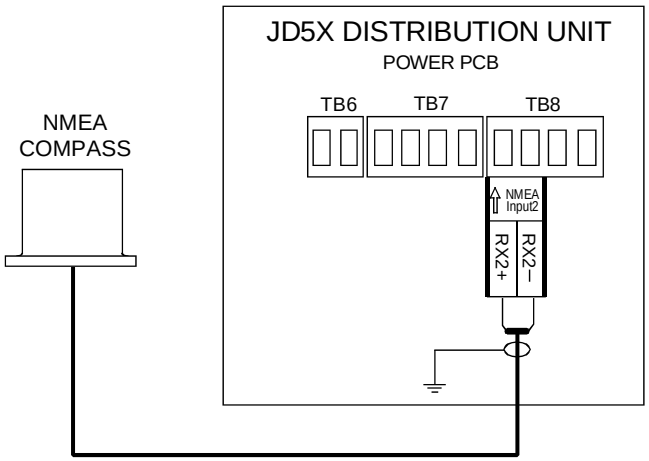


Figure 2-43 NMEA compass connection

Note ! *An output of 10 Hz or faster is recommended.*

Radar Clock / Data

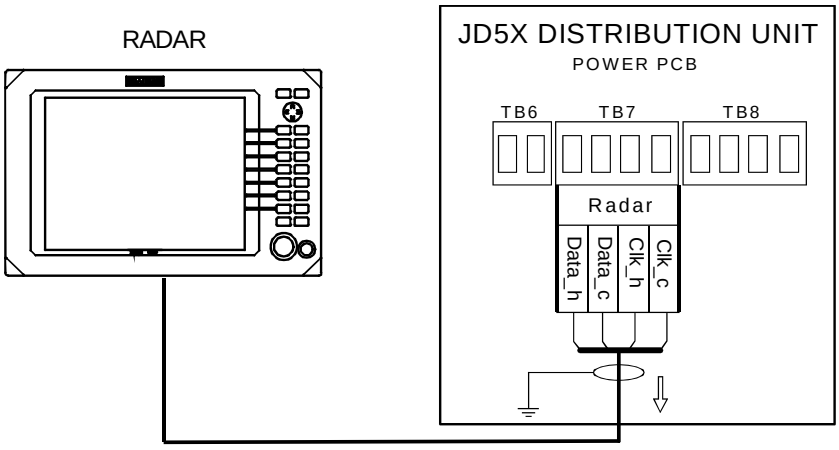


Figure 2-44 Radar Clock/Data Connections

Analog Heading Repeater

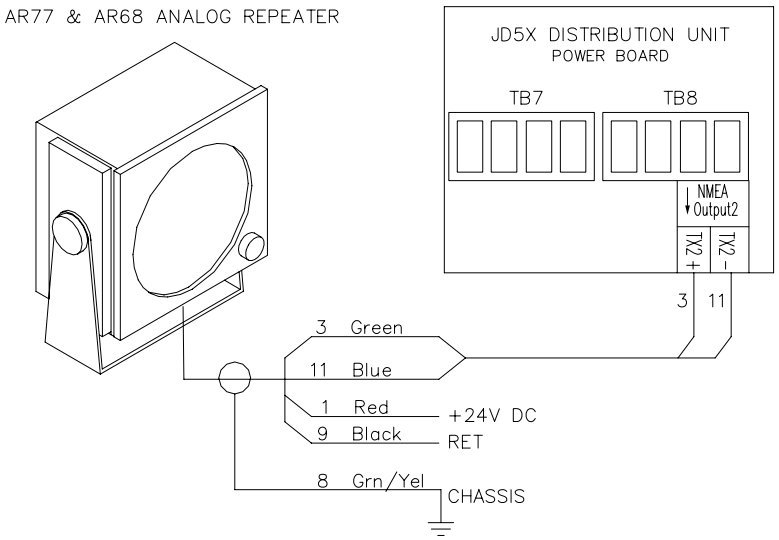


Figure 2-45 AR77 and AR68 Analog Heading Repeater Connections

Digital Heading Repeater

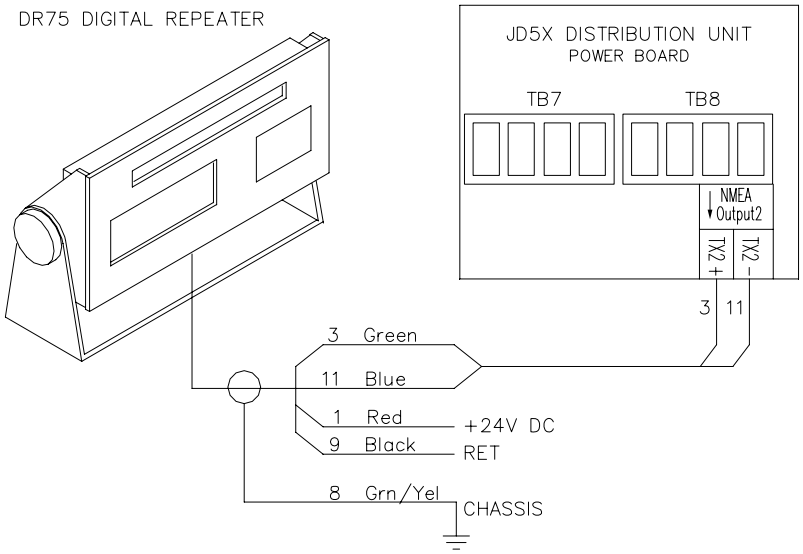


Figure 2-46 DR75 Digital Heading Repeater Connections

GI51 Gyro Interface

The GI51 Gyro Interface is required when a gyrocompass with geared synchro or stepper signal output is connected to the AP50.

The GI51 is also required when a speed log signal with 200 pulses/NM is connected to the system.

Refer to separate installation manual for GI51 (document no. 20221594)

NI300X NMEA Interface Unit

The NI300X NMEA Interface Unit is normally installed inside of a console or locker close to navigation receivers, radar, and instruments to keep the cables short. The unit does not have controls that need to be operated during installation or use, but you should be able to take the lid off for inspections and to view LED indication of received signals. It should be installed with the cable inlet and the Robnet connectors facing down. The NI300X is designed to operate in locations with temperatures below +55°C (+130°F). It is fastened to the panel/bulkhead by the external mounting brackets.

Note ! *The NI300X is not weatherproof and must be installed in a dry location!*

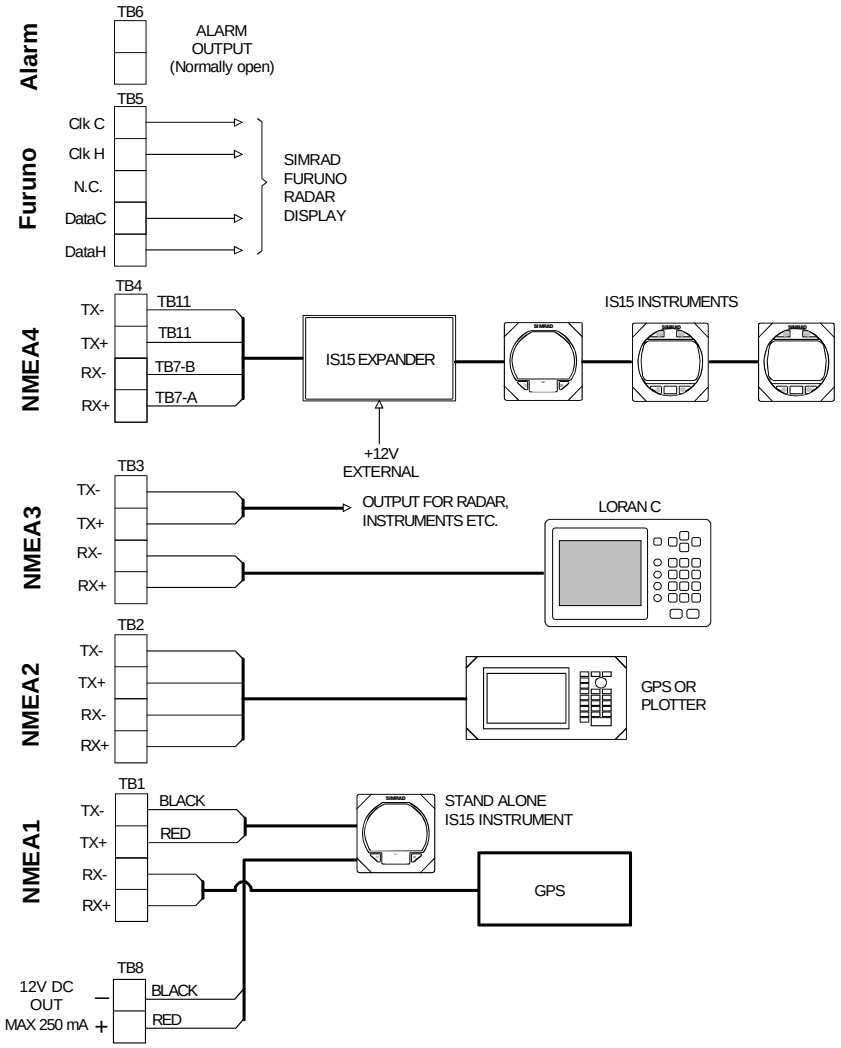


Figure 2-47 NI300X NMEA Interface Unit Connections

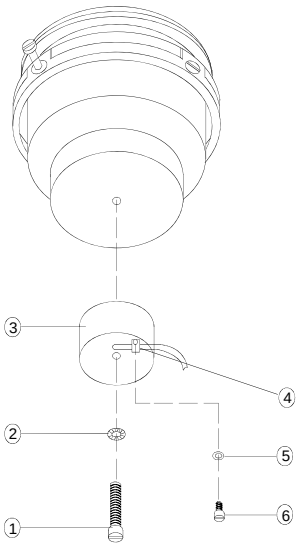
The NI300X NMEA Interface (expansion) Unit is designed for installations in which more NMEA lines have to be tied into the system. Four NMEA ports, which are identical in hardware and software, are available and can be connected as desired. An additional output data-port with a DATA/CLOCK signal is capable of generating heading data in the format used by some radar displays made by Simrad and Furuno.

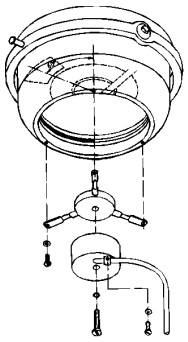
The 12V output is designed for driving instruments with a total maximum load of 250 mA.

Configuration for Simrad or Furuno is selected in the Installation Interface Menu (see page 66).

CD100A Course Detector

The owner may prefer to use the boat's own compass. The compass must be fully gimbaled and have a flat surface underneath to fit the CD100A. Make a hole for a 6 mm screw in the bottom of the compass and mount the CD100A as shown in Figure 2-48. Secure the 6 mm screw through the center hole of the CD100A. Make sure the cable does not prevent the compass from moving freely in the gimbals.





1	Screw M6x25mm, non magnetic
2	Washer, non magnetic
3	Course detector
4	Cable clamp, nylon
5	Washer, non magnetic
6	Screw M3x10mm, non magnetic

Note!

Lock nut on mounting screw (pos. 1) for transportation only. To be removed before mounting.

When the course detector is mounted on a reflector compass, use the tripod holder (ref. to *Figure 6-5* on page 105).

Figure 2-48 CD100A Course Detector Mounting

CDI35 Interface

Install the CDI35 Interface as close to the compass as possible so that it will be easy to find in the event of servicing.

Put the two fixing screws in the slots and secure the unit to the bulkhead. Open the unit to access the screw terminals.

Connect the cables as shown in Figure 2-49.

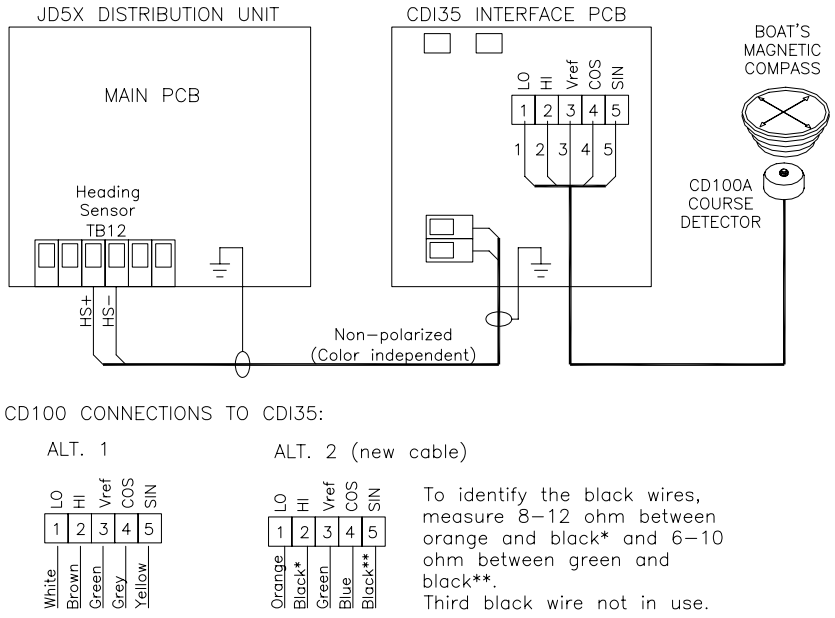


Figure 2-49 CDI35 Interface Connections

Note ! *The CD100 is a previous model and its cable has a connector that must be cut off for connection in the AP50 system (e.g. to the GI51 or the CDI35).*

CD109 Course Detector

For retrofit installations, a CD109 Course detector may be connected to the CDI35 according to Figure 2-50.

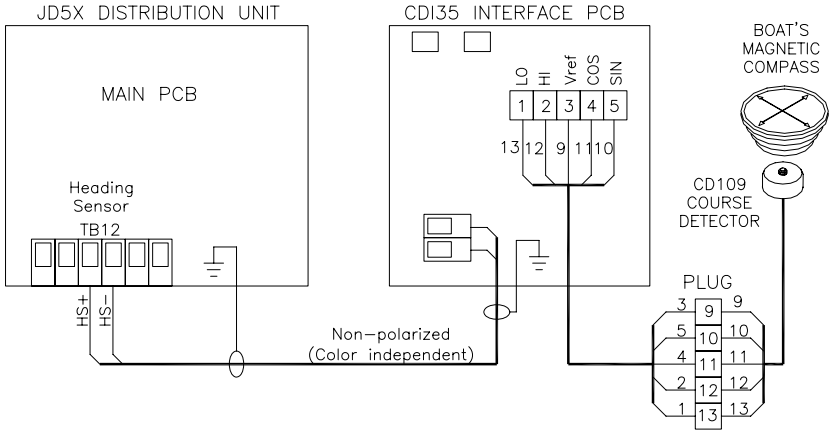


Figure 2-50 CD109 Course detector connections to CDI35 Interface

3 SOFTWARE SET-UP PROCEDURE

3.1 Description of Installation Set-up

The design of the AP50 includes advanced features that have simplified the installation and set-up of an autopilot. The principle advantage is that the manual adjustments that needed to be made on previous models are no longer necessary with the AP50.

Note !

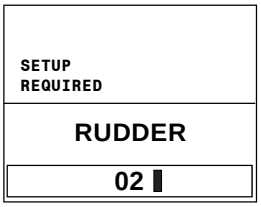
The Installation Set-up must be performed as part of the installation of the AP50 system. Failure to correctly set the values in the Installation Set-up menu may prohibit the AP50 from functioning properly!

The Installation Set-up is grouped into the following functional categories:

- Language: Selects the language used for display information.
- Dockside Settings: Sets the values for items to be set prior to sea trials.
- Interface Set-up: Sets the identification of navigation equipment and optional equipment connected to the AP50 system.
- Sea-trial Settings: Determines the automatic calibrations and the steering parameters and sets the compass offset.
- Service: Used to view system parameters, perform NMEA tests, and Master reset system memories.
- Settings: Setting or changing steering and thruster parameters.

Each category is designed to focus on specific functions related to an installation activity and to enable quick access when changes need to be made.

Some important points regarding the Installation Set-up values:



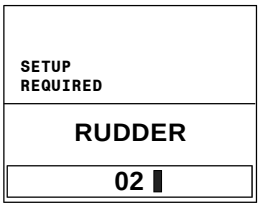
- When the AP50 is delivered new from the factory, (AND ANY TIME AFTER A MASTER RESET OF MEMORIES HAS BEEN PERFORMED), the Installation Set-up values are all reset to preset (default) values. The warning message "Setup Required" will appear at “turn on” and if an attempt to access the AUTO or NAV modes is made.
- The Dockside and Interface settings can only be accessed when the system is in Standby mode.
- The values that are selected in the Installation Menu are

stored in the memory of the AP50 system. No specific action is required to save the selected values to memory. Once the value is changed, it is stored until the next time the menu item is selected and changed.

- The Installation Set-up is considered global (except language), which enables the values to be available to all control units in the system.
- The values in the Seatrial Settings are dependent on the successful completion of the Dockside Settings.
- In the table on page 93 the range of each setting is listed. Note the final value selected during the Installation Set-up, and also note any changes of values.

Before attempting to turn on the AP50 and perform an Installation Set-up, the hardware installation and electrical installation must be completed and performed in accordance with the installation instructions.

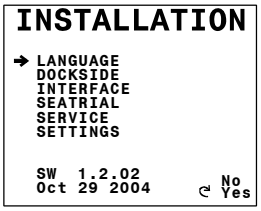
3.2 Installation Menu



A single press on the STBY (STBY) button switches the system on. After approximately 5 seconds, the unit that was turned on will show the Standby mode display. When the AP50 is delivered new from the factory (and any time after a master reset of memories has been performed), the Installation Set-up values are all reset to preset (default) values. The warning message "Setup Required" will appear at “turn on” and if an attempt to access the AUTO or NAV modes is made.

When a JD5X Distribution Unit is installed, the AP50 system automatically detects during power up and set-up whether dual analog steering gears or steering gears with dual directional valves are connected.

For ON/OFF control (JD50, JD51 and JD52) the directional valve solenoids are operated directly. For analog control (JD53) the continuous control signal commands rudder angle to the steering gear electronics.



Rudder direction and maximum and minimum values are set under the AP50 Installation menu. These settings determine the operating voltage range of the rudder control signal.

The Installation Menu is presented on the autopilot display by pressing and holding the NAV SETUP (NAV/SETUP) button for 5 seconds.

Note ! *The Installation Menu is different from the User Set-up Menu. Refer to the flow diagram on page 53 for a pictorial view of the Installation Menu.*

Navigate through the Installation Menu as follows:

- Answer “Yes” to a question by rotating the course knob clockwise.
- Answer “No” to a question by pressing the (STBD) button. This will allow you proceed to the next menu item.
- Return to the previous menu item by pressing the (PORT) button.
- Change the selected item shown by rotating the course knob in either direction.
- Exit the Installation Menu by pressing STBY, AUTO or NAV buttons.

On new installations, and whenever a junction unit or software is replaced in an AP50 system, it is recommended that a Master Reset be performed as described under SERVICE in the Installation Menu (see page 81) prior to proceeding with the set-up procedure.

Note !

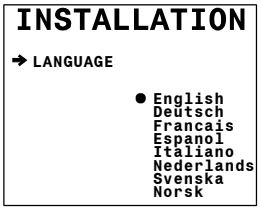
If a “Change-Over” switch is installed (page 18) it must be set to the “Auto” position, otherwise the rudder can not be calibrated for direction and feedback signal in the Dockside menu.

When using the Installation Menu refer to Figure 3-1 "Installation Menu Flow Chart" on page 53.

Language selection

The AP50 can present the display in eight different languages:

- English, Deutsch, Francais, Español, Italiano, Nederlands, Svenska and Norsk.



To access the language selection in the Installation Menu:

1. Answer “Yes” by turning the course knob clockwise.
2. Turn the course knob to select the language you wish to use.
3. Continue to next item in the Installation Menu by pressing the (STBD) button or leave the Installation Menu by pressing the (STBY) button.

Dockside

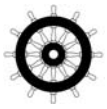
The following menu items are accessible and can be set up in the Dockside Set-up Menu:

- Master operation
- Boat type
- Boat length
- (Drive unit voltage)

- Rudder / Feedback calibration
- Rudder test
- Rudder limit
- Rudder deadband
- Thruster type

Select STANDBY mode and enter the Installation Menu as previously described. Select "Dockside" by pressing ⇨ (STBD) button and confirm by rotating the course knob clockwise.

Master Operation



```
INSTALLATION
        DOCKSIDE
➔Master operation    Yes
  Boat type  Displacement
  Boat length          ---
  Drive unit voltage   ---
  Rudd feedb cal STBD  ---
  Rudd feedb cal PORT  ---
```

For vessel that comply with the European Marine Equipment directive, one control unit must be set for **Master operation,** if more than one control unit is connected. The other unit(s) is then automatically set as a “slave”. The system can only be switched off from the master unit (see also Operator Manual, Master Operation).

If your system is to be wheelmarked you have to answer yes for **Master operation** on one of the control units by rotating its course knob. This applies only to commercial vessels classed to follow the Marine Directive.

Press the ⇨ (STBD) button to proceed to the next menu item.

Note !

Whenever boat type or boat length is changed, all steering parameters will be reset to default values.

Boat Type

```
INSTALLATION
        DOCKSIDE
  Master operation    Yes
➔Boat type  Displacement
  Boat length          ---
  Drive unit voltage   ---
  Rudd feedb cal STBD  ---
  Rudd feedb cal PORT  ---

        ↻Displacement
          Planing
          Waterjet
```

The actual **Boat type** is selected by turning the course knob. The options are: **Displacement** hull, **Planing** hull, and **Waterjet** propelled.

The type of boat selected will affect the steering parameters and the functions available in the autopilot system. Select the appropriate **Boat type** and press the ⇨ (STBD) button.

Boat Length

```
INSTALLATION
        DOCKSIDE
  Master operation    Yes
  Boat type  Displacement
➔ Boat length    0-50 FEET
  Drive unit voltage   ---
  Rudd feedb cal STBD  ---
  Rudd feedb cal PORT  ---
↻ 0-50 FEET    90-130 FEET
  40-70 FEET   120- FEET
  60-100 FEET
```

The actual boat length is selected by turning the course knob. The options are: **0-50 feet**, **40-70 feet**, **60-100 feet**, **90-130 feet**, and **120- feet**. For those boats that may qualify for two categories (e.g. 45 ft.) it is recommended that faster/lighter boats be placed in the shorter category.

The **Boat length** will affect the steering parameters. Select the appropriate boat length and press the ⇨ (STBD) button.

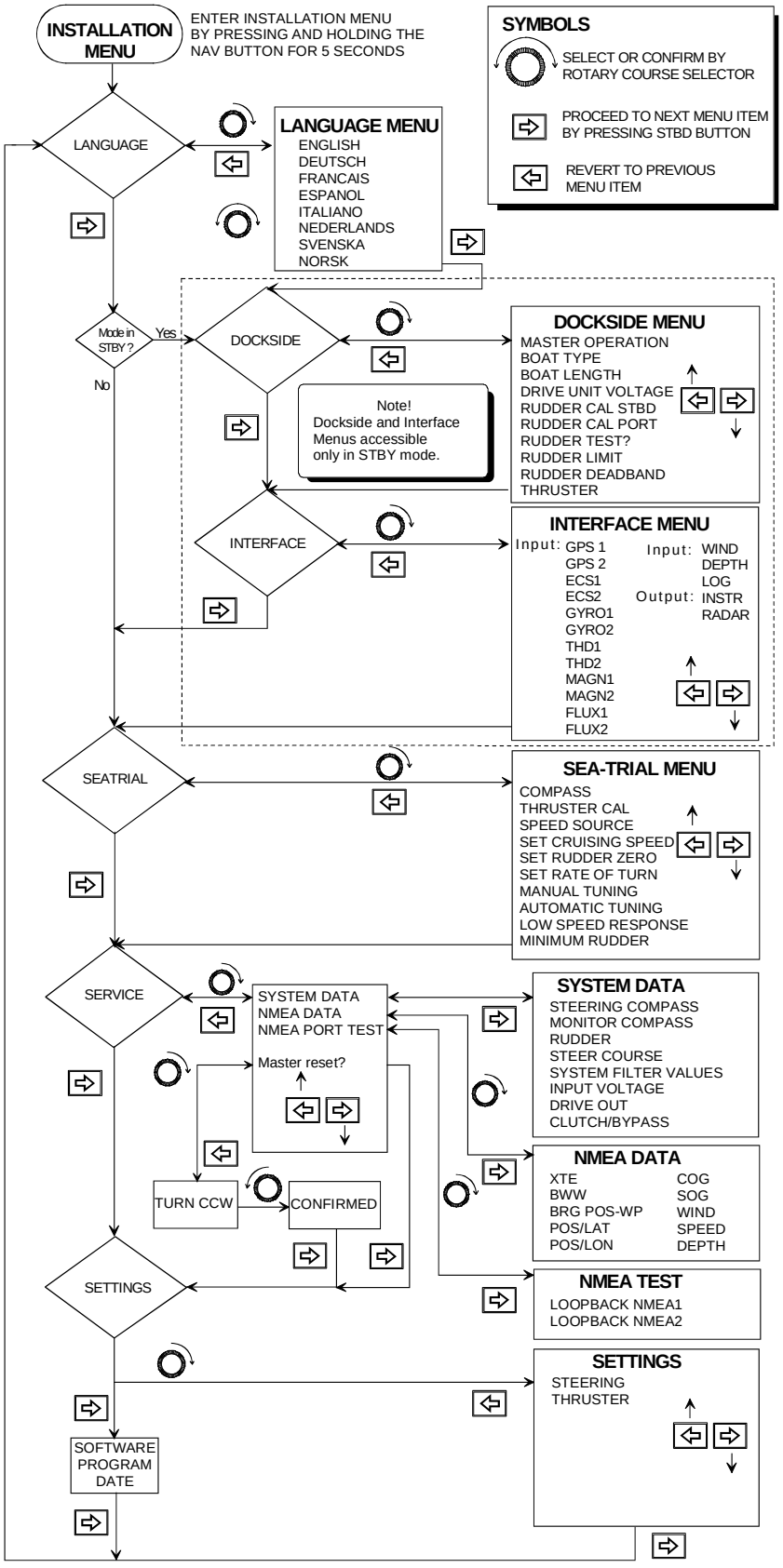


Figure 3-1 Installation Menu Flow Chart

Drive Unit Voltage

The **Drive unit voltage** setting does not apply when operating solenoids on a continuous running pump/steering gear. Hence, the output voltage to the solenoids will be the same as the input voltage.

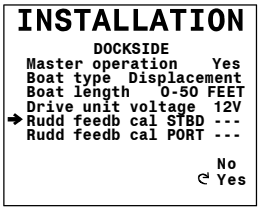
Note !

If the Drive Engage port (TB6) on the Power Board is used, the port voltage is the same as the selected Drive Unit Voltage (ref. page 84.

Proceed to the next menu item by pressing the ⇨ (STBD) button.

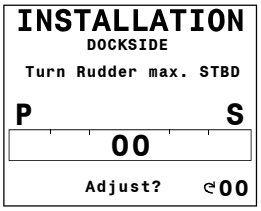
Rudder Feedback Calibration

(Applies for JD50, JD51 and JD52 distribution units)



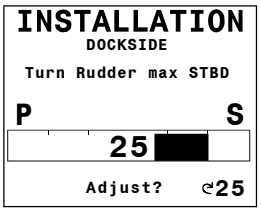
Make sure the rudder feedback unit is installed and aligned as pr. instructions in section 2.6 (RF14XU) or 2.7 (RF45X) before attempting the **Rudder feedback calibration**.

This function enables you to compensate for non-linearity in the mechanical transmission between the rudder and the rudder feedback unit.



Select **Rudder feedback calibration STBD** by turning the course knob clockwise. “Turn Rudder max STBD” will be displayed on the screen.

Manually turn the helm wheel to starboard until the rudder stops at maximum starboard rudder.



The value shown on the display is the value read by the feedback unit before any adjustment is made. The bargraph indicates to which side the rudder is positioned. Be sure to set the correct rudder angle and direction by turning the course knob. The autopilot uses this value as physical stop. Physical stop minus 2° will be used as “max. rudder limit” and determines how far the autopilot can under any circumstance, drive the rudder.

Note !

If the rudder feedback unit is mounted upside down, the displayed rudder angle may be to the opposite side before you start the adjustment (arrow pointing to Port). In this case, turn the course knob starboard until the rudder angle indicator displays the correct starboard value.

Advance to the next step by pressing the ⇨ (STBD) button.

Manually turn the helm wheel to port until the rudder stops at maximum port rudder.

Adjust the displayed angle the same way as for starboard adjustment (if the rudder feedback unit is upside down, you need not correct for the opposite side this time).

Note ! *If no adjustment has been made to the display readout (i.e. not turning the course knob), the AP50 will set the physical stop to 45°. "Max. rudder limit" will be set to 2° less.*

Note ! *Rudder-zero may still be inaccurate and should be adjusted later during sea trial.*

Proceed to the next menu item (Rudder Test) by pressing the ⇨ (STBD) button.

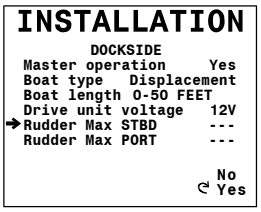
Rudder Calibration

(Applies for JD53 Distribution Unit only)

Note ! *All required adjustments for both voltage and current are set via the Installation menu and therefore no adjustments of the PCB trim potentiometers shall be made.*

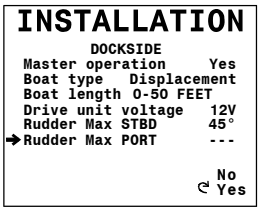
There is a common setting of max. port and stbd. rudder angle for both rudder drives. The amount of voltage or current corresponding to max port and stbd travel for each rudder drive is however set individually.

Use the following procedure for calibrating the rudders:

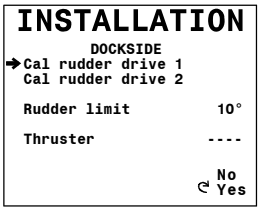


Enter "Installation, Dockside menu and select "Rudder Max STBD".

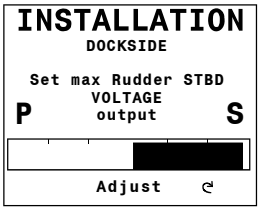
Turn the course knob and set the required max rudder travel to a little less than the extreme hard-over position.



Press the ⇨ (STBD) button to enter "Rudder Max PORT" Turn the course knob and select max travel to port. Note that this sets the maximum travel for rudders or azimuth thrusters whichever is applicable.

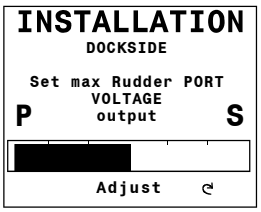


Press the ⇨ (STBD) button to enter "Cal rudder drive 1".

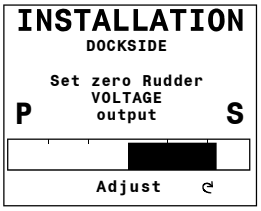


Turn the course knob CW and observe that the display shows "Set max Rudder STBD Voltage output".

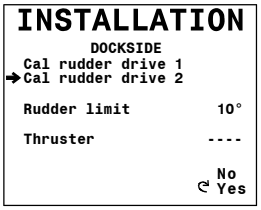
Turn the course knob to obtain STBD rudder by turning the knob CW or CCW. Observe the rudder angle indicator and output voltage and continue to turn the course knob until the rudder has reached the previous selected maximum angle to STBD.



Press the ⇨ (STBD) button and observe that the display shows "Set max Rudder PORT Voltage output". Turn the course knob CCW to obtain max PORT rudder deflection observed by the rudder angle indicator.



Press the ⇨ (STBD) button and adjust the zero rudder. Note that with two parallel rudders, water jets or other propulsion units, it may be beneficial to apply a little "tow-out" offset for each rudder.

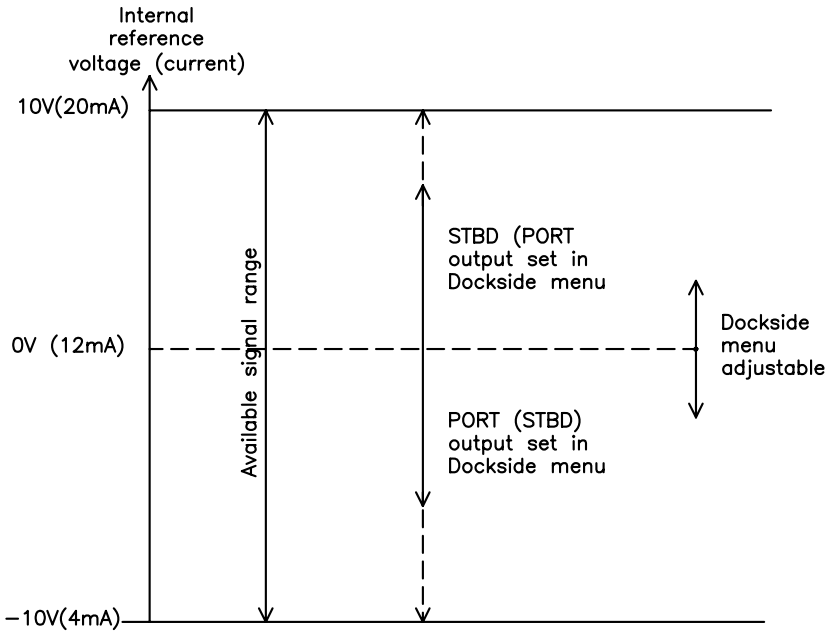


Repeat the same calibration procedure for "Cal rudder drive 2", and apply a little offset to the opposite direction when setting the zero point.

Note that every time the "Voltage output" display is shown, the steering system must be set for autopilot control, either manually or via "System select". Refer to "System Select" in the AP50 Installation Manual.

Note!

Rudder Zero = 0 will give full range and equal level of the signal to each side, but will be limited by the Maximum rudder setting. If Rudder Zero is set different from 0, part of the available signal range is used for permanent offset and the remaining range available for control will therefore be less in one direction (ref. Figure 3-2 for details).



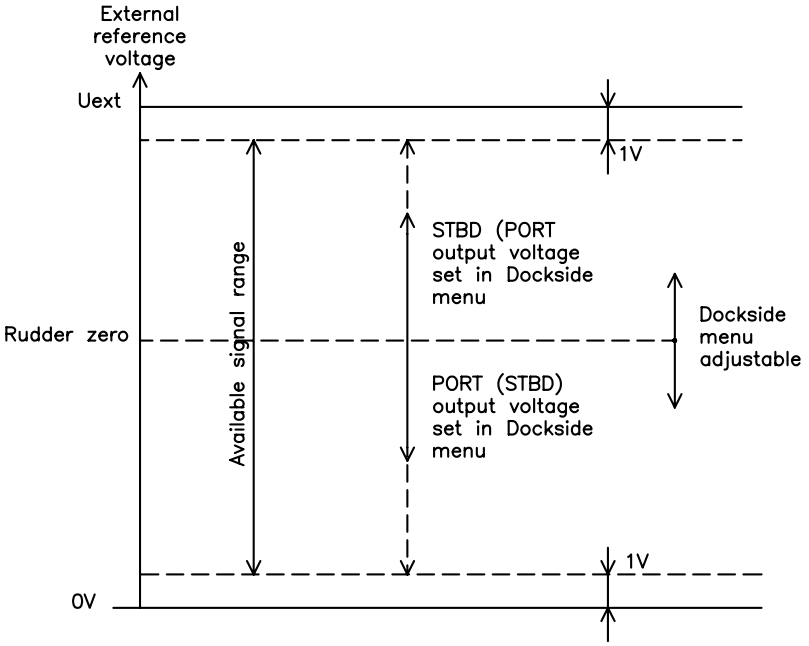


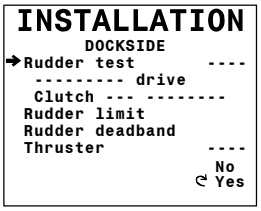
Figure 3-2 Internal and external references

Rudder Test

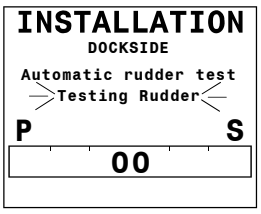
(Applies for JD50, JD51 and JD52 distribution units)

Note !

Bring the rudder manually to midship position before starting the test. If the boat uses power-assist steering, it is important that the engine or electric motor used to enable the power-assist steering is turned on prior to this test. Stand CLEAR of the wheel and do not attempt to take manual control of the wheel during this test!



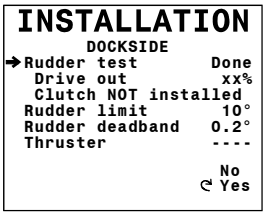
Activate the automatic **Rudder test** by turning the course knob clockwise.



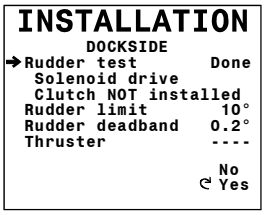
The AP50 will, after a few seconds, issue a series of PORT and STBD rudder commands, automatically verify correct rudder direction, detects minimum voltage for running, and reduce the rudder speed (reversing pumpset or proportional valves) if it exceeds the maximum acceptable speed for autopilot operation.

The **Rudder test** is verified by the display showing ‘Motor OK’, ‘Proportional OK’, ‘Solenoids OK’, or ‘Failed’. If ‘Failed’ is given, check for correct electrical connection and also make sure that the steering engine is selected for autopilot control (ref. to ‘Change-Over Switch’ on page 18).

When test is finished the display will read:



or



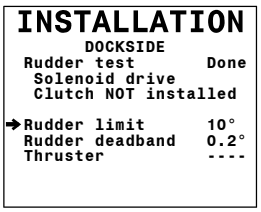
The **Drive out** (displayed in percentage) is the amount of maximum available voltage needed to achieve correct rudder speed when automatic steering (Maximum speed is used in NFU steering).

It will be indicated on the screen whether a clutch is installed or not.

If the Automatic rudder test fails, refer to ”Warnings” in the Operator Manual.

Proceed to the next menu item by pressing the (STBD) button.

Rudder Limit



Rudder Limit determines the maximum rudder movement in degrees from the “used” midship position that the autopilot can command the rudder in the automatic modes.

“Used” midship position is the rudder angle required to maintain a straight course.

The **Rudder limit** setting is only active during autosteering on straight courses, NOT during course changes. This **Rudder limit** does not affect WORK, Non-Follow-up or Follow Up steering. In WORK, Non-Follow-up or Follow Up steering, only the max. rudder limit applies.

Note !

The max. rudder limit was set automatically to physical stop minus 2° when the rudder feedback calibration was performed.

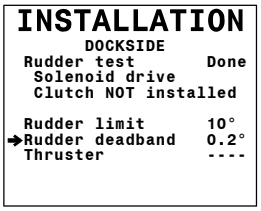
Range: 5° to max. rudder limit in 1° steps.

Default: 10°

Proceed to the next menu item by pressing the (STBD) button.

Rudder Deadband

(Applies for JD50, JD51 and JD52 distribution units)



Necessary deadband to avoid the rudder from hunting is calculated and set automatically during the rudder test. Therefore this parameter should normally not be adjusted. If the auto-setting does not perform properly (rudder commands due to vibration of the rudder when under way), it can be adjusted manually. A narrow deadband may cause the rudder to hunt and a wide deadband will create inaccurate steering.

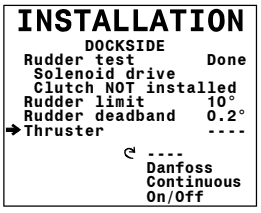
Adjust the **Rudder deadband** by rotating the course knob. Find the lowest possible value that will prevent the rudder from hunting. It is recommended to check rudder stability and accuracy in FU-mode.

Range: Auto, 0.1° to 4.0° in 0.1° increments.

Default: Auto.

Proceed to the next menu item by pressing the (STBD) button.

Thruster



Select the type of thruster connected to the autopilot system.

Select between: – –- – – (no thruster connected), **Danfoss** (Danfoss PVEM valve), **Continuous** (analog: ±10V internal, 4-20 mA or external ref. voltage) or **On/Off** (On/Off solenoid).

"Continuous" must also be selected for Proportional Directional control (ref. TI51 Instruction Manual).

Proceed to the next menu item by pressing the (STBD) button.

Note !

*Before use of the thruster, the Thruster sea-trial set-up has to be performed to set the **Thruster direction** and the **Maximum thrust**.*

Interface Set-up

The AP50 system provides a flexible approach to the input of data from heading sensors and other external equipment. Identification of the type of equipment connected to the AP50 system is performed in the Interface Menu.

To be able to display all the information on the instrument screens (see section "Instrument Screens and Menu" in the Operator Manual), refer to the table in section 6.16 on page 113 for the required NMEA sentences.

When your system includes connection of external equipment to the NMEA0183 data ports in the junction unit or the NI300X NMEA Interface, or if the GI51 Gyro Interface is installed with optional compass units, they must be configured in the Interface Menu. This procedure allows you to assign an abbreviated name to identify the type of equipment that is connected to each of the available hardware ports in the AP50 system.

Caution ! ***The ECS1 and ECS2 set-up items are intended for connection to professional navigators where the radius for the course change is preset in the chart system. This turn radius will allow the ship to turn before the waypoint is reached and enables the AP50 to follow a route seamlessly.***

Note ! *Confirmation for course change by the user will not be required. Users navigating in this mode must show extra caution!*

When connecting a GPS or a Chartplotter, use the GPS1 or GPS2 set-up item.

The Interface Set-up Menu presents names so that they can be assigned to the hardware input or output port (see Table 3-1 on page 61. Each abbreviated name is then presented in the appropriate locations of the User Set-up Menu (see Operator Manual) to provide the user with choices of data sources.

Upon completion of the Interface Set-up, it is recommended that the configuration be recorded in the Interface Set-up Table on page 63.

Abbreviated name	Equipment / Usage	NOTES
GPS1	Primary GPS/Chart Plotter	Can be used as either Nav. source or Speed source
GPS2	Backup GPS/Chart Plotter	
ECS1 *	Primary Electronic Chart System	
ECS2 *	Backup Electronic Chart System	
GYRO1	Any primary gyro	NMEA, syncho or step signal input
GYRO2	Backup gyro for GYRO1	
THD1	Transmitting Heading Device	NMEA input
THD2	Transmitting Heading Device	
MAGN1	Magnetic compass with course detector (CD100A)	1) CD100A + CDI35 connected to JD5X
MAGN2	Magnetic compass with course detector (CD100A)	2) CD100A directly connected to CI300X
FLUX1	For use with fluxgate compasses	Robnet, NMEA, sine/cosine or JD5X Heading Sensor (HS) input
FLUX2	For use with fluxgate compasses	
WIND	For wind sensor	NMEA input
DEPTH	For depth sensor	
LOG	For speed sensor	NMEA or pulse log
Output INSTR	NMEA output of compass heading or VDR data	HDG or HDT output increased from 1 to 5 times/sec. on TX1 port. HDT and RSA 5x/sec.
Output RADAR	Clock/data heading output to radars	May select Simrad, Furuno, or Special** (for both JD5X and NI300X)

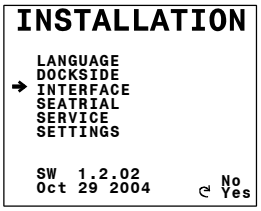
* Automatic course change at waypoint will now occur during navigation in NAV mode.

** For future use.

Table 3-1 Interface Menu

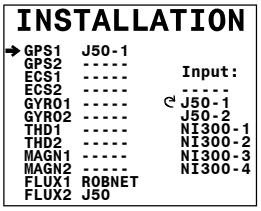
Output signal	Output terminal	Output sentence
Continuous output of 10 Hz NMEA compass heading	Distribution unit, Power PCB, NMEA2, TX2+, TX2–	HDT or HDG (input dependent)

Table 3-2 Permanent NMEA Output on Port 2



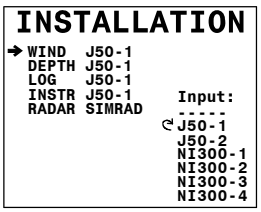
To begin Interface set-up, proceed to the Interface Set-up menu under the Installation Menu.

To access the Interface Set-up items, turn the course knob clockwise.



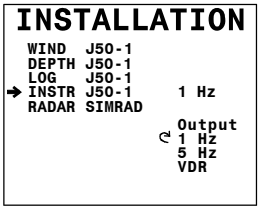
The display now shows the first name on the list. Select the hardware port where that device is connected by turning the course knob until the appropriate hardware port is displayed.

Proceed to the names on the list that should be assigned by pressing the ⇨ (STBD) button. Assign the appropriate hardware ports by turning the course knob, or exit from the menu by progressing through the list of names by pushing the ⇨ (STBD) button.



Note !

Upon completion of the Interface Set-up, the names of items to which you have assigned hardware ports will be available as sources of data for compass, navigation, and speed in the User Set-up Menu. It is recommended that you access the User Set-up Menu directly after completing the Interface Set-up to select the desired data. Refer to the Operator Manual for details on changing the items in the User Set-up Menu.



The standard NMEA output rate is 1 Hz. If INSTR J50-1, is set to 5 Hz, the output port, TX1, will have an output rate of 5 Hz for HDG or HDT (heading) messages. NMEA OUTPUT 2 on the JD5X has a constant output rate of 10 Hz for HDG or HDT (see Table 3-2 on page 61. Both port 1 and 2 are still sending HDM at 1 Hz. HDM is an obsolete sentence, but some older equipment may still use it (see table on page 113).

If INSTR is set to VDR, rudder command, response and heading data as defined in IEC61996, is provided at 5 Hz in the HTD and RSA sentences.

Interface Set-up - Input Signal

Set-up item (abbrev. name)	Equipment connected (name)	Connected to terminal (use one available from list)	Assign hardware port to set-up item (* = default setting)
GPS1		Not connected	– – – –
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1*
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
GPS2		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
ECS1		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
ECS2		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
GYRO1		Not connected	– – – – *
		Connection to Robnet	ROBNET **
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
		GI51, Gyro terminal	GI-sync
		GI51, Gyro terminal	GI-step
		GI51, Gyro terminal	GI-0183
		GI51, Gyro terminal	GI-prop

Set-up item (abbrev. name)	Equipment connected (name)	Connected to terminal (use one available from list)	Assign hardware port to set-up item (* = default setting)
GYRO2		Not connected	– – – – *
		Connection to Robnet	ROBNET **
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
		GI51, Gyro terminal	GI-sync
		GI51, Gyro terminal	GI-step
		GI51, Gyro terminal	GI-0183
		GI51, Gyro terminal	GI-prop
THD1		Not connected	– – – – *
		Connection to Robnet	ROBNET **
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
THD2		Not connected	– – – – *
		Connection to Robnet	ROBNET**
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
MAGN1		Not connected	– – – – *
	CD100A + CDI35	Distribution unit: HS+, HS–	J50-HS
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
	CD100A	CI300X Magnetic Compass terminal	CI300X
MAGN2		Not connected	– – – – *
	CD100A + CDI35	Distribution unit: HS+, HS–	J50-HS
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
	CD100A	CI300X Magnetic Compass terminal	CI300X

Set-up item (abbrev. name)	Equipment connected (name)	Connected to terminal (use one available from list)	Assign hardware port to set-up item (* = default setting)
FLUX1		Not connected	– – – –
	RC25	Connection to Robnet	ROBNET*
		Distribution unit: HS+, HS–	J50-HS
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
		CI300X, Analog terminal	CI300X
FLUX2		Not connected	– – – – *
	RC25	Connection to Robnet	ROBNET
		Distribution unit: HS+, HS–	J50-HS
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
		CI300X, Analog terminal	CI300X
WIND		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
DEPTH		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
LOG		Not connected	– – – – *
		JD5X, Main PCB NMEA I/P RX1+,RX1–	J50-1
		JD5X, Power PCB NMEA I/P RX2+,RX2–	J50-2
		NI300X, NMEA port #1	NI300-1
		NI300X, NMEA port #2	NI300-2
		NI300X, NMEA port #3	NI300-3
		NI300X, NMEA port #4	NI300-4
		GI51 Pulse log terminal	GI-LOG

JD5X = All distribution unit models

Set-up item	Equipment connected	Connected to terminal	Assignment
INSTR	Instrument system Instrument system Voyage Data Recorder	JD5X, Main PCB	1 Hz* 5 Hz VDR
RADAR	Radar Radar Future option	JD5X, Power PCB, TB9	Simrad* Furuno Special **

* Default setting
** For future use.

Table 3-3 Interface Set-up - Output Signal Port 1

Sea Trial

Caution !

The Sea Trial must always be performed in open waters at a safe distance from other traffic.

A sea-trial can only be performed if the Dockside Settings are completed and confirmed. It is also important that the Interface Set-up be performed prior to adjusting sea trial settings.

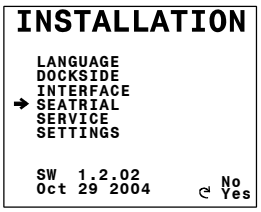
The following sea trial settings must be set:

- Compass calibration (to automatically compensate for onboard magnetic deviation)
- Compass Offset (to offset the final compass heading readout)
- Max/Minimum thrust, thrust direction and levels (only if thruster is selected)
- Set cruising speed (in the AP50)
- Set rudder zero (to indicate the precise midships position of the rudder)
- Set rate of turn at cruising speed (to select your preferred turn rate). **It is essential that this setting is carried out.**

If the boat steers satisfactorily, there is no need to perform the Manual or Automatic tuning.

The following sea trial settings may be used as optional settings:

- Manual tuning (Steering parameters: Rudder, Counter Rudder)
- Automatic tuning (an optional method of determining the steering parameters)
- Speed response (to tell how the rudder gain shall be adjusted automatically by vessel speed)



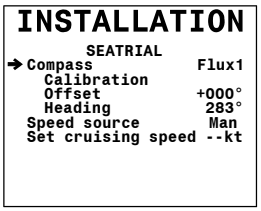
The Sea Trial menu is selected by rotating the course knob clockwise.

Compass Calibration

This function will activate the automatic compass calibration procedure (for Simrad compasses connected through Robnet and through JD5X distribution unit Heading Sensor (HS) terminal, and compasses connected through GI51).

Note !

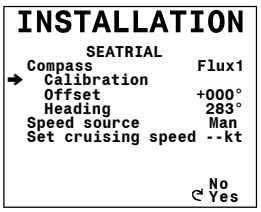
If an optional magnetic compass is installed and connected to JD5X or GI51, or if a gyrocompass, or other manufacturer's fluxgate is connected to a GI51, it is still required to perform the automatic compass calibration in order to calibrate the heading/input signal. Not applicable for stepper and geared synchro signals.



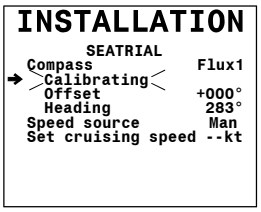
Select the compass to be calibrated.

Before you begin the compass calibration procedure, make sure you have enough open water around you to make a full turn with the boat.

The calibration should be done in calm sea conditions with minimal wind to obtain good results.

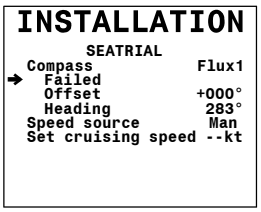


Press the ⇨ (STBD) button to select the **Calibration** function.



1. Begin turning the boat (port or starboard) and establish your turning rate.
2. Start compass calibration by turning the course knob clockwise. The display will flash **"Calibrating"**.

When calibration is completed (after having completed approximately 1 1/4 turns), it will be verified by the display reading **"Confirmed"**.



If the compass is too close to magnetic objects, the compass calibration may fail and the display will show **"Failed"**.

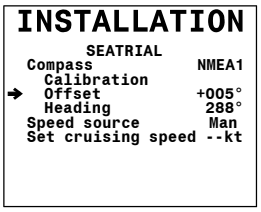
In that case, move the compass to a more suitable location and re-calibrate.

After calibration, check the compass readout against a known reference, compensated compass, or leading line. If the reading is correct (±3° for magnetic compass, ±0.5° for gyrocompass) except for a fixed offset, proceed to the next menu item by pressing the ⇨ (STBD) button or return to STANDBY mode by pressing the STBY (STBY) button.

Note ! *If an optional NMEA compass from Simrad or another manufacturer is installed, refer to the optional compass' manual regarding calibration.*

Compass Offset

The compass **Offset** feature allows you to correct for a constant compass heading offset. This offset may be present as a result of the compass being installed with a lubber line offset or if a fixed offset remains after the calibration procedure has been completed. The value of compass offset is specific to the heading sensor that is selected at the time the offset is entered. This means that you can have individual offsets for each compass installed.



Select the amount of correction by turning the course knob to offset the heading to agree with the known, accurate heading. The **Offset** value can be either positive or negative.

Note ! *If an Offset still exists after having accounted for it, one of the following problems may still exist:*

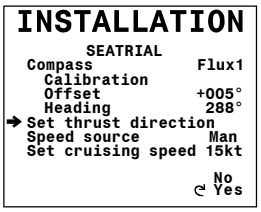
- The heading reference to which you are comparing the compass is not accurate.
- The automatic calibration obtained by the compass is not correct. This may be due to a large magnetic influence near the compass (relocation may be required) or to excessive wave condition during calibration.

Note ! *Do not compare with GPS' COG, since your GPS is showing course, rather than heading.*

Proceed to the next menu item by pressing the ⇨ (STBD) button or return to Standby mode by pressing the STBY (STBY) button.

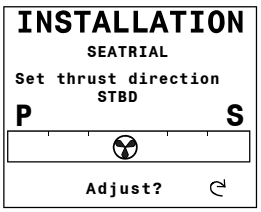
Set Thrust Direction, On / Off Thruster

(ONLY IF ON/OFF THRUSTER IS SELECTED, proceed to page 70 if continuous thruster or Danfoss thruster is selected)



Rotate the course knob clockwise to activate the **Set thrust direction** setting.

Rotate the course knob to starboard and verify that the vessel turns to starboard. The thruster stops after 10 seconds, or when the ⇨ (STBD) button is pressed.



If the boat turns to port when the course knob is turned to starboard, rotate the knob to port to ensure a starboard turn.

This tells the autopilot which direction to turn the thruster.

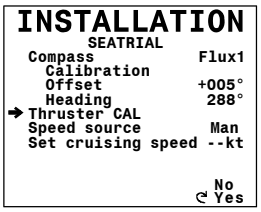
For ON/OFF thrusters, a change in direction command will always be delayed 1 second to prevent thruster breakage.

Note !

If advanced set-up of the thruster is required, refer to the SETTINGS menu on page 90.

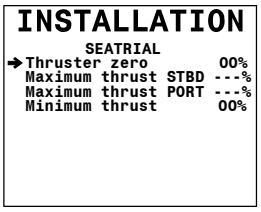
Proceed to the "**Speed source**" item on page 71 by pressing the ⇨ (STBD) button or return to STANDBY mode by pressing the STBY (STBY) button.

Thruster Calibration, Analog Thruster



(ONLY IF CONTINUOUS THRUSTER OR DANFOSS THRUSTER IS SELECTED)

Rotate the course knob clockwise to select the **Thruster CAL** display.



Thruster zero

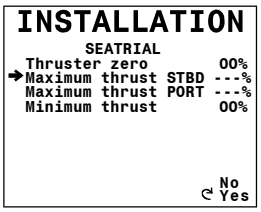
Rotate the course knob until you have no output effect from the thruster. The Thruster zero offset is now set.

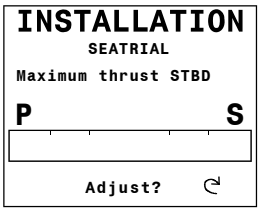
Range: -50% to +50% in step of 1%.

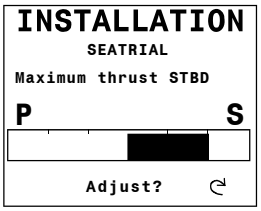
Default: 0%.

Proceed to the **Maximum thrust STBD** item by pressing the ⇨ (STBD) button.

Direction and Maximum Thrust STBD, Analog Thruster







(ONLY IF CONTINUOUS THRUSTER OR DANFOSS THRUSTER IS SELECTED)

Rotate the course knob clockwise to activate the **Maximum thrust STBD** setting.

Rotate the course knob to starboard and verify that the boat turns to starboard. Adjust the bargraph until maximum thrust is obtained. The thruster will run for 10 seconds after last adjustment has been carried out.

If the boat turns to port when the course knob is turned to starboard, rotate the knob to port to ensure a starboard turn. Adjust the bargraph until maximum thrust is obtained.

This tells the autopilot which direction to turn the thruster.

Proceed to the **Maximum thrust PORT** item by pressing the ⇨ (STBD) button.

Direction and Maximum Thrust PORT, Analog Thruster

(ONLY IF CONTINUOUS THRUSTER OR DANFOSS THRUSTER IS SELECTED)

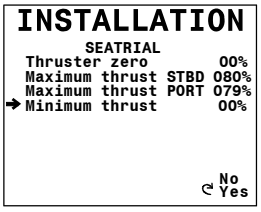
Rotate the course knob clockwise to activate the **Maximum thrust PORT** setting. Adjust the baragraph until you get maximum thrust in port direction.

This tells the autopilot which direction to turn the thruster.

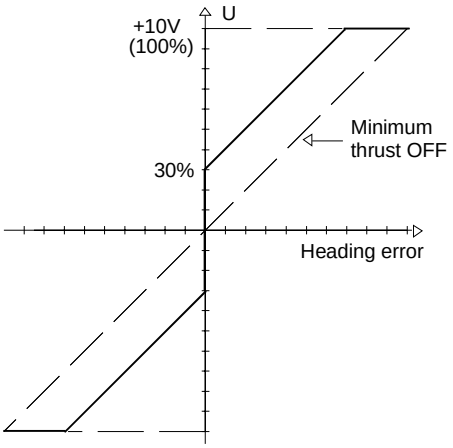
Proceed to the **Minimum thrust** item by pressing the ⇨ (STBD) button.

Minimum Thrust, Analog Thruster

(ONLY IF CONTINUOUS THRUSTER OR DANFOSS THRUSTER IS SELECTED)



The **Minimum thrust** determines the amount of power (in % of the maximum control signal) that is applied as the "first command signal".

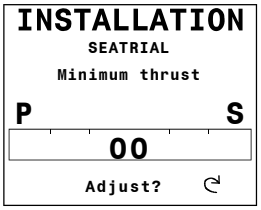


The example shows 30% of the control signal applied as **Minimum thrust**.

The dotted line shows the output signal for **Minimum thrust** set to 0.

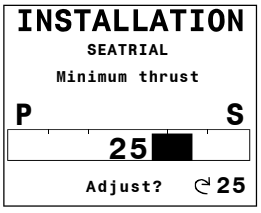
Range: 0-50% in step of 1%.

Default: 0%.



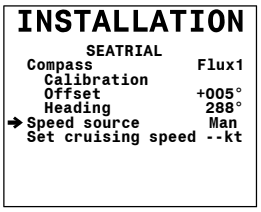
Rotate the course knob clockwise to activate the **Minimum thrust** setting.

Rotate the course knob to port or starboard to find the minimum amount of thrust you must apply as “first command signal”.



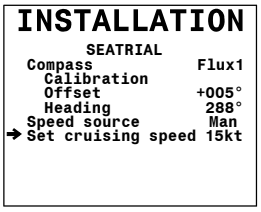
Proceed to the **Speed source** item by pressing the (STBD) button or return to STANDBY mode by pressing the (STBY) button.

Speed source



Select the **Speed source** setting. Refer to Interface Set-up table on page 63. If no speed source is available, set the **Speed source** to **Man** and proceed to the **Set cruising speed** item by pressing the (STBD) button or return to STANDBY mode by pressing the (STBY) button.

Set Cruising Speed



Steer the boat at cruising speed. The speed is shown at the **Set cruising speed** line. Rotate the course knob clockwise to confirm the cruising speed.

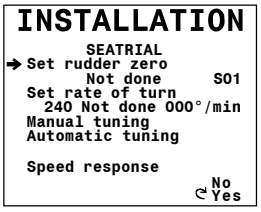
If **Speed source** is set to **Man**, adjust for actual cruising speed by the course knob.

Proceed to the **Set rudder zero** item by pressing the ⇨ (STBD) button or return to STANDBY mode by pressing the STBY (STBY) button.

Set Rudder Zero

(Not applicable for analog drive)

This adjustment should be made in calm sea with little side forces from wind or current.



- Bring the boat up to cruising speed and head directly into the wind.
- If the boat has twin engines, synchronize the engines' RPM's.
- Set the trim tabs and stabilizers to have no effect on the boat's heading.
- Steer the boat manually on a steady course.
- Confirm the rudder zero position by rotating the course knob clockwise.

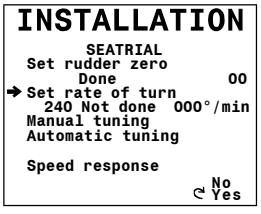
Proceed to the **Set rate of turn** function by pressing the ⇨ (STBD) button or return to STANDBY mode by pressing the STBY button.

Set Rate of Turn

(Applies for JD50, JD51 and JD52 distribution units)

The setting determines both the **Rate of turn** and the **Turn gain** (ref. Settings Menu, page 89) used for course changes in automatic steering modes. It is essential that this setting is carried out at sea when the boat is turning. To avoid setting at dockside it is blocked for rate of turn less than 5°/min.

Before this setting, the display shows **'Not done'** with default rate of turn to the left. Afterwards the display reads **'Done'** with set value to the left. The present rate of turn is always shown to the right.



At cruising speed, make a manual, constant turn. When you have an acceptable turn and the **Rate of turn** reading is stable, rotate the course knob clockwise to confirm the setting. Verify that the rate value and **'Confirmed'** is displayed.

The **Rate of turn** may be readjusted at any time while in

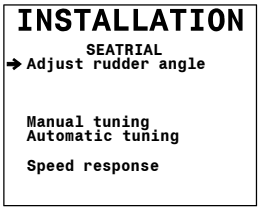
automatic modes (Ref. User Set-up in the Operator Manual). The **Turn gain** may also be readjusted (Refer to Turn Gain on page 89).

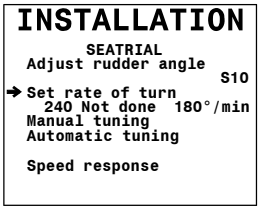
Note !

*The **Set rate of turn** function is only activated when using the course knob, NOT the Port and STBD buttons.*

Proceed to the next function by pressing the ⇨ (STBD) button.

Adjust rudder angle / Set rate of turn





(Applies for JD53 Distribution Unit only)

The **Adjust rudder angle** adjustment is part of the **Set rate of turn setting** when analog rudders are used for steering.

The setting determines both the **Rate of turn** and the **Turn gain** command when turning. It is used at course changes in automatic steering modes. It is essential that this setting is carried out.

At cruising speed, make a constant turn by turning the course knob. When you have an acceptable turn and the rate of turn reading is stable, press the ⇨ (STBD) button to select **Set rate of turn**. Rotate the course knob clockwise to confirm the setting. Verify that the rate value and **'Confirmed'** is displayed.

Proceed to the next function by pressing the ⇨ (STBD) button.

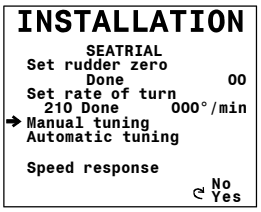
Manual Tuning

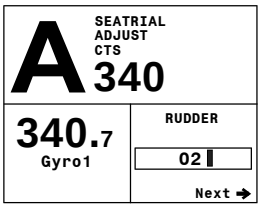
If the boat steers satisfactorily, there is no need to perform the **Manual** or **Automatic** tuning.

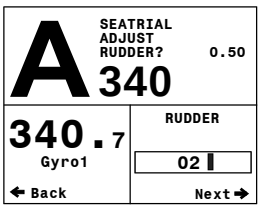
The two most important parameters that determine the performance of the automatic steering are **Rudder** and **Counter Rudder**.

These parameters have already been automatically set in the Installation Dockside menu as scaling factors of the boat type and boat length.

These settings may also be accessed at any time in the User Set-up menu (see Operator Manual) under the automatic modes.







Run the boat at cruising speed. Rotate the course knob clockwise to activate the Manual Tuning. The AP50 will now control the steering of the boat. If another course is desired, rotate the course knob until the desired course is obtained. After the course has stabilized, observe the steering performance.

If you need to change the steering parameters to improve the performance and are familiar with manual adjustment, press the ⇨ (STBD) button and adjust the values according to the description below. Otherwise proceed to Automatic tuning by pressing the ⇨ (STBD) button several times.

Rudder

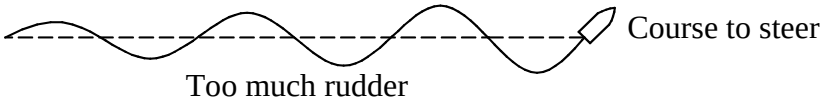
Rudder sets the rudder gain, which is the ratio between the commanded angle and the heading error (p-factor).

Range: 0.05 to 4.00.

- Too little **Rudder** and the autopilot fails to keep a steady course.
- Too much **Rudder** gives unstable steering (hunting) and reduces speed.

Low speed requires more rudder than high speed (see **Speed Response**, page 77).

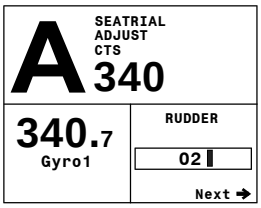
Too little rudder



Too much rudder

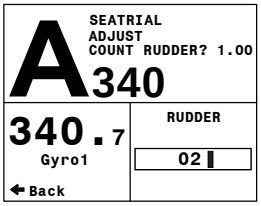
While at cruising speed, adjust the **Rudder** value by turning the course knob until the autopilot keeps the boat on a steady course.

Counter Rudder



Press the (STBD) button to display the set course. Make a 90° course change (CTS) by rotating the course knob and observe the transition to the new set course.

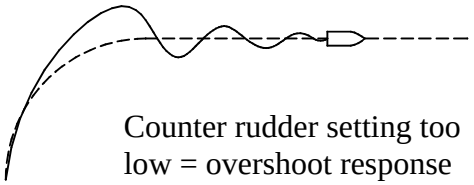
Press the (STBD) button again to adjust the **Counter rudder** value, if necessary, according to the following:



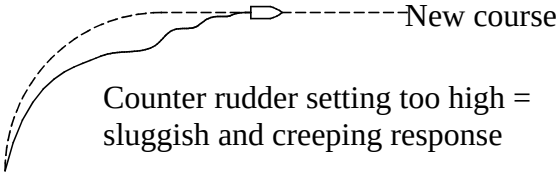
Counter rudder is the parameter that counteracts the effect of the boat's turn rate and inertia. It is superimposed on the normal rudder response as provided by the rudder parameter. It may sometimes appear as if the autopilot tends to make the rudder move in the opposite direction of the turn (counter rudder).

The figures illustrate the effects of various **Counter rudder** settings.

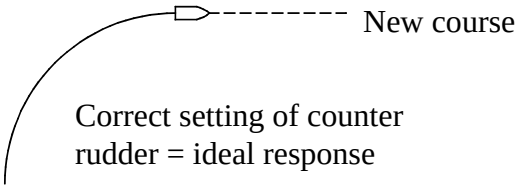
Range: 0.05 to 8.00.



Counter rudder setting too low = overshoot response



Counter rudder setting too high = sluggish and creeping response



Correct setting of counter rudder = ideal response

Go back to previous screen by pressing the (PORT) button, make a new 90° course change by rotating the course knob and observe the transition to the new set course. Press (STBD) button again to adjust the **Counter rudder** value if necessary

Proceed to **Speed Response** by pressing the (STBD) button or return to STANDBY mode by pressing the (STBY) button.

Automatic tuning

If the boat steers satisfactorily, there is no need to perform the **Automatic** tuning.

Automatic tuning is a feature that automatically sets the two main steering parameters (**Rudder** and **Counter Rudder**) by taking the boat through a number of S-turns.

Selecting the boat type and length has set default values for these parameters (Installation Dockside menu). Before doing any parameter tuning, check if the boat steers satisfactory with the default setting (can be checked as described under Manual Tuning or by normal Auto steering).

Recommended speed during Automatic tuning varies with the type of boat, but it should not exceed 10 knots.

Note !

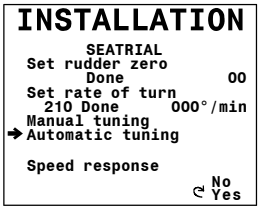
Automatic tuning *should not be performed at planing speed!*

For displacement boats, use a speed that is approximately half the normal cruising speed (i.e. if cruising speed is 10 knots, do the **Automatic tuning** at about 5 knots).

If possible, perform the **Automatic tuning** steering East or West, as this will yield the best-balanced parameters.

WARNING !

The Automatic tuning function will take control of the boat and perform a number of S-turns. It must always be performed in open waters at a safe distance from other traffic. The Automatic tuning function may take from 1 to 2 minutes to complete. To stop the Automatic tuning, press the (STBY) button.



Activate **Automatic tuning** by rotating the course knob clockwise.

After the **Automatic tuning** has been completed, the autopilot will return to STANDBY mode and the rudder must be controlled manually.

When the **Automatic tuning** has been completed, there should be no need for further adjustments to the **Rudder** and **Counter Rudder**, but the speed response must be set. However, on certain installations, you may want to "fine tune" the parameters after the **Automatic tuning** due to special steering characteristics of the specific boat. One may view or change the **Automatic tuning** parameters in the User Set-up menu (see Operator Manual).

Speed Response

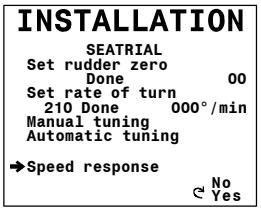
To make this adjustment you need speed input from either SOG or Log.

The **Speed response** adjusts the relationship between speed and amount of rudder, with lower speed requiring more rudder.

This adjustment should be done at slow speed as follows:

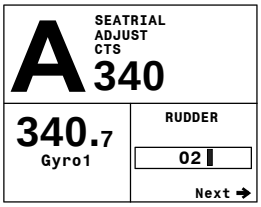
For displacement and planing boats, steer at minimum operating speed.

If there is a big difference in steering performance for a planing boat before and after planing, refer to **Transition speed** on page 87.

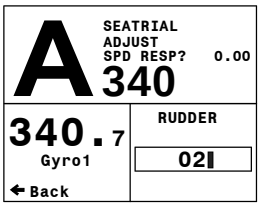


For water jet, steer at a speed that begins giving reasonable response from the main steering.

From the Sea trial menu, select **Speed response** by rotating the course knob clockwise. The AP50 will now take control over the steering of the boat.



If another course is desired (CTS), rotate the course knob until the desired course is obtained.



Proceed to the **Speed response** adjust screen by pressing the ⇨ (STBD) button. Rotate the course knob to set the **Speed response** parameter to the level at which the vessel steers satisfactorily at slow speed. Change of speed will now automatically adjust the rudder gain in an adaptive manner between slow speed and cruising speed.

Range: 0.00 – 2.00

Exit the Seatrial Settings menu by pushing the ⇨ (STBD) button to proceed to the System Data menu, or press the STBY (STBY) to return to normal AP50 operation.

3.3 Final Test

After having completed all the settings in the Installation Menu, take the boat out and perform a final sea trial in open waters at a safe distance from other traffic.

- Steer the boat on all cardinal headings in AUTO mode.
- Start with low and medium speeds to get familiar with the response from the AP50.
- Try the DODGE, U-turn, and C-turn functions.

- If a Non-Follow Up lever (or handheld remote) is connected, test change of modes and verify port and starboard steering commands of the lever.
- Set waypoints into each navigator connected to the system, and verify that the AP50 steers in NAV mode for each Nav. source.
- Provide user training.

3.4 Providing User Training

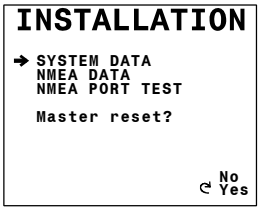
The user should be instructed in the "basic" operational functions, such as:

- Turning the system on and off.
- Changing modes. Explain briefly what takes place in the different modes.
- Regaining manual control from any mode. Point out in what modes the helm is engaged by the autopilot.
- Taking command at an "inactive" station, if applicable.
- Using the lock mode, how to lock/unlock, and how to shut the system down from a locked control unit, if applicable.
- Use of the Non-Follow-up and Follow-up steering modes and learning the difference between the two.
- Use of a Non-Follow-up and Follow-up controller, if connected.
- Changing course by rotary knob and buttons.
- Moving through the User Set-up Menu in STANDBY, AUTO, NAV, and WORK modes learning how to (and why to) change the settings.
- Knowing the difference between normal parameters and WORK parameters also including Nav. source and Compass sensor selection, if applicable.
- Locating any compasses and knowing to keep all magnetic items away.
- Locating the Mains circuit breaker.
- Knowing the different uses of thruster (Follow-up, Non-Follow-up, and WORK modes).

4 ADVANCED SETTINGS

4.1 Service Menu

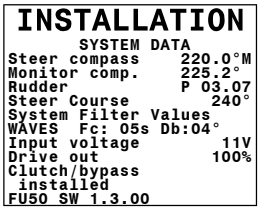
Select STANDBY mode and then enter the Installation Menu by pressing and holding the NAV/SETUP button for 5 seconds. Select "SERVICE" by pressing the (STBD) button and confirm by rotating the course knob clockwise.



"SYSTEM DATA" and "NMEA DATA" are test functions to analyze data processed by the AP50.

To exit the menu, press any mode key (STBY, AUTO or NAV).

System Data



Select "SYSTEM DATA" by rotating the course knob clockwise. This menu provides you with additional system data that can be useful when testing or trouble shooting the system.

Steer compass

Steering Compass readout, M=Magnetic, T = True.

Monitor comp.

Monitor Compass readout.

Rudder

Rudder angle. Normally between 0 and 45°.

Steer Course

Current steered course in AUTO and NAV modes.

System Filter Values

Values set by the automatic sea state filter (in AUTO and NAV modes).

Fc = Wave filter time constant in seconds.

Db = Deadband in degrees to each side of the set course. The boat has to be outside the deadband before the autopilot responds.

Input voltage

Mains voltage on input terminals.

Drive out

Power needed to drive the unit (in percent of full [100%]) to get satisfactory rudder speed. (Refer to page 85 for adjustment).

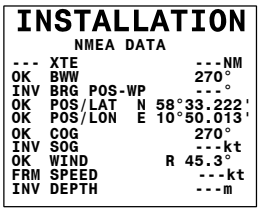
Clutch/bypass

Verifies if a clutch or bypass valve has been activated when performing the rudder test.

FU50 SW

Shows the software version for a connected FU50 Steering Lever

NMEA Data



Select the "NMEA DATA" by pressing the (STBD) button and confirm this by rotating the course knob clockwise.

The menu provides you with status information about the different NMEA messages used by the system.

Decoding

The incoming signals are decoded according to a built-in priority table in the AP50. Cross Track Error and bearing information is taken from the NMEA messages with highest priority.

For all data items, one of the following codes will be displayed:

--- No data or no NMEA sentence containing the data needed at the input port.

OK Valid data found

INV A message with invalid information.

FRM Message has a format failure such as:

a) Incorrect check sum

b) Wrong contents in the datafield(s)

If data are missing or invalid, perform the following:

- Check the NMEA signal monitor (see below).
- Check the interface setup in the Installation Menu (see page 59).
- Check the navigator set-up and make sure it is transmitting appropriate NMEA data.
- Perform a NMEA Port Test (hardware) (see below).

Note ! *The “WIND” reading is the apparent wind from the left (L) or right (R). The “SPEED” reading is the speed through water.*

NMEA Signal Monitor

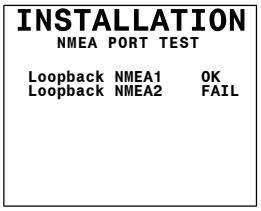
Near the NMEA terminals in the junction unit you will find a green monitor LED (Refer to Distribution Unit Terminals, page 17). A flickering LED indicates that a NMEA signal is received. It does not, however, qualify the contents of the message.

Note !

Do not confuse this “RX” LED with the LED marked “TX”. The “TX” LED will always be lit/flickering when the autopilot is on.

NMEA Port Test (JD5X hardware)

Disconnect the cables on the Main PCB in the distribution unit and connect TX1+ to RX1+ and TX1– to RX1–. Similarly, on the Power PCB, connect the NMEA ports the same way: TX2+ to RX2+ and TX2– to RX2–.



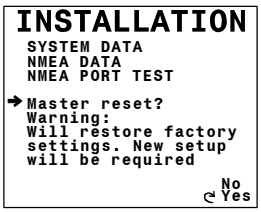
Under SERVICE in the Installation Menu, select "NMEA PORT TEST" by pressing the ⇨ (STBD) button and confirm this by rotating the course knob clockwise.

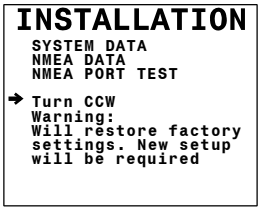
Verify that the hardware is OK. If not, replace the corresponding PCB(‘s).

Master Reset

Note !

A Master Reset will reset the memories to factory settings. Unless you need to clear all stored values during the installation set-up procedure, you should not perform a Master Reset. A Master reset will not clear the stored compass calibration and offset values in RC25, RFC35, JD5X and GI51.

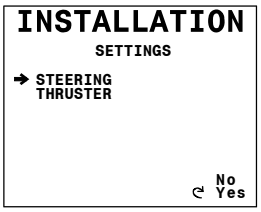




The Master Reset needs a double confirmation to prevent an accidental reset. To perform a Master Reset, rotate the course knob clockwise and then rotate the course knob counter-clockwise.

Exit the Installation Menu by pressing the STBY (STBY) button to return to normal AP50 operation.

4.2 Settings Menu



Select SETTINGS in the Installation Menu by pressing the (STBD) button and confirm this by rotating the course knob clockwise.

Two groups of settings are available; **Steering** and **Thruster** (only when thruster is installed).

Note !

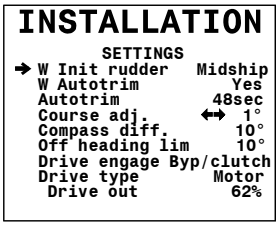
If a thruster is not installed, the Steering menu appears when entering the Settings menu.

Use the (PORT) or (STBD) buttons to move through the menu items. Turn the course knob clockwise or counter clockwise to adjust the values.

Steering

Select STEERING by pressing the (STBD) button and confirm this by rotating the course knob.

W Init rudder



Select between Midship or Actual rudder position in Work mode.

When “Midship” is selected, the autopilot will use zero degrees as the midship reference. Hence, the rudder will always move to midship when switching from STANDBY or DODGE mode to AUTO-WORK or NAV-WORK mode.

When “Actual” is selected, the autopilot will use the current rudder position as the midship reference (bumpless transfer) when switching from STANDBY or DODGE mode to AUTO-WORK, or NAV-WORK.

Note !

“Midship” will always be used when switching to AUTO or NAV from STBY/NFU/FU.

W Autotrim

Rotate the course knob to turn the **Autotrim** function off or on in the AUTO-WORK and NAV-WORK modes.

Autotrim

When the vessel has a constant heading error due to external forces such as wind and current, the **Autotrim** function corrects for this by building up a constant rudder offset.

The value for the **Autotrim** parameter is the time it is allowed to calculate the rudder offset.

The **Autotrim** value can be adjusted from 10 seconds to 400 seconds with the course knob. The default value depends on the boat length.

The **Autotrim** parameter is reset every time the AUTO mode is entered or when a course change greater than approximately 20° is made by the course knob.

Autotrim is automatically disabled during a turn.

Course Adjust

When using the ⇦ (PORT) or ⇨ (STBD) buttons in AUTO mode, you are changing the set course in 1° increments. If you prefer the increments to be 5° or 10° each press, proceed as follows:

Select ***Course adjust*** using the ⇦ (PORT) or ⇨ (STBD) button. Turn the rotary knob to display the setting. The default value is 1°, which is the preferred setting. Select 5° or 10° if you want to make major course changes in 5° or 10° increments with the buttons and fine-tune the set course with the course knob.

Compass difference

When two compasses are used (main compass and monitor compass), there is virtually always a difference between the readings of the two. If the difference in reading exceeds the set limit for **Compass diff.**, an alarm is given.

Range: 5 to 35°.

Default: 10°.

Note ! *The difference between the two compass readings may vary with the vessel's heading and from one area to another where a vessel is in transit. The difference between the two compass readings is automatically reset when the **Compass diff.** alarm is given and then reset.*

Off Heading lim

This sets the limit for the 'Vessel off course' alarm. This alarm occurs when the actual heading deviates from the set heading by more than the selected limit.

Range: 3 to 35°.

Default: 10°.

Drive engage

This determines the use of the JD5X Drive Engage port (TB6). The port voltage is the same as the selected Drive Unit voltage. Drive engage has the following different settings:

Bypass/clutch:

This port will activate (go high), in all modes except for STANDBY and DODGE hand-steering.

It is typically used to engage a bypass valve for a hydraulic linear drive. It may be used to start a hydraulic pump when entering Follow-up, Non-Follow-up, AUTO and NAV. modes.

Auto:

The port will activate (go high) in AUTO and NAV modes.

"Auto On" is typically used to switch the pump speed when different rudder speeds are needed in automatic and Follow-up/Non-Follow-up steering. The switch is normally off.

Handshake 1:

This setting is specially made for interfacing with KaMeWa's CanMan standardized system but can also be used for similar installations. Manual steering is performed from a joystick. On top of the joystick, there is an override button for manual takeover from the autopilot. The Drive Engage and Remote port (regardless which one) of JD5X is used as handshake signals between autopilot and manual steering system as follows:

If AUTO, NAV or FU is selected, the Drive Engage port will go high causing the autopilot to take control. When STBY is pushed on the autopilot, Drive Engage will go low and the manual steering system will take control. If the override button is activated in AUTO or NAV, the pilot will go into STBY but Drive Engage remains high, and the boat can be steered manually by the joystick. When the override button is released, the autopilot will take control again under new current heading (AUTO) or ongoing track (NAV). Pushing the override button in FU-mode will be identical to pushing the STBY button, i.e. Drive Engage goes low and pilot remains in STBY.

NFU and Dodge from autopilot will not be possible when Handshake 1 is set.

Drive type

This indicates the type of drive installed. The display will show “Motor”, “Solenoid”, “Proportional” or “Analog”, respectively.

The reading is obtained from the Automatic rudder test under the Dockside menu. The set value may be changed here.

Drive out

Not applicable for “Analog” drives.

Shows the amount of power needed to achieve the correct rudder speed. The reading is obtained from the Automatic rudder test under the Dockside menu. The set value may be increased or decreased here.

Range: 4-100%

Default: 50%, updated during Rudder Test.

Prop. gain

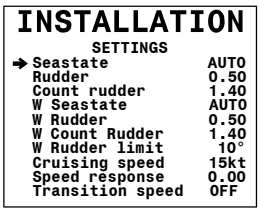
Applicable only for “Proportional” drive.

This parameter is set automatically when the Rudder Test is done in the Dockside menu. It influences the start/stop slope of the rudder. The value could be increased if rudder response to a start/stop command feels too slow. The value could be decreased if start/stop feels too quick and causes rudder angle overshoot or hydraulic shock when stopping.

Range: 1-20

Default: 13, updated during Rudder Test.

Seastate



Seastate determines the number of degrees the vessel may fall off the set course before any response is given to the rudder.

OFF: Provides precise steering but increases rudder activity.

AUTO: Automatically reduces the rudder activity and sensitivity of the autopilot in rough weather.

MANUAL: Sets yaw band manually (MAN 1-MAN 10, 10 ≈ ±6°).

Default: AUTO

Refer to the Operator Manual/*User Set-Up Menu/Auto Mode*.

Rudder

Rudder sets the rudder gain, which is the ratio between the commanded angle and the heading error. Default value depends on boat length.

Range: 0.05 to 4.00.

Counter rudder

Counter Rudder is the parameter that counteracts for the effect of the boats turn rate and inertia. The default value depends on boat length.

Range: 0.05 to 8.00.

W Seastate

As for **Seastate** above but applies for the Work-modes.

W Rudder

As for **Rudder** above but applies for the Work-modes.

W Count rudder

As for **Counter rudder** above but applies for the Work-modes.

W Rudder limit

This determines the maximum rudder movement, in degrees from the “used” midship position, that the autopilot can command the rudder in the WORK modes.

Default: 10°.

The W Rudder limit setting is only active during AUTO-WORK and NAV-WORK steering on straight courses, NOT on course changes, but a Rudder Limit warning will be shown during course changes.

Cruising speed

If the **Cruising speed** was not set during sea trial or needs to be changed, it can be set manually here. Refer to page 72.

Range: 3 – 70 knots

Default: 15 knots

Speed response

This adjusts the value for the **Speed response** (see page 77).

Range: 0.00 – 2.00

Default: 0.00

Transition Speed

(Only appears in the Settings menu when “Planing” or “Waterjet” is selected as the “Boat type”.

To make this adjustment you need speed input from either SOG or Log.

Planing boats may often have very different steering characteristics before and after planing. The same may apply for water jet driven boats at low and high speed. AP50 offers the possibility of using the Auto-Work mode values for Rudder and Counter Rudder at low speed. By setting the **Transition Speed** to a value different from the default = 0, the Work parameters for Rudder, Counter Rudder and RateOfTurn/Radius will automatically be used for speed below the set value.

Note !

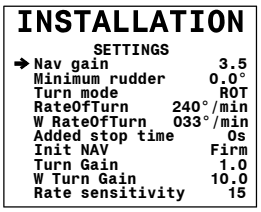
Other special work functions (thruster control, disabling of special alarms etc.) do not apply without the Work mode being manually selected.

For a planing boat it is recommended to set the **Transition Speed** to the value that represents the speed where the hull begins to plane. For a water jet boat it should be set to a value that represents the speed where it begins giving good response from the main steering.

Range: OFF - 40

Default: OFF

Nav Gain



The **Nav Gain** determines how many degrees the autopilot must change the vessel’s heading in order to bring the vessel back on track, using the Cross Track Error and the vessel’s speed (refer also to the Operator Manual/*User Set-Up Menu/Nav Mode*).

Range: 0.5 to 7.

Default: Depends on the boat length.

Minimum rudder

Some vessels may have a tendency of not responding to small rudder deflection around “used” midship position because of a possible rudder deadband or whirls/disturbance of the water-stream passing the rudder.

By setting the Minimum Rudder to a certain value, the autopilot will add this value to any given rudder command.

The amount of rudder command is determined by adding the minimum rudder value and the rudder deadband value to the p-factor value.

Minimum Rudder	0.1°
Rudder deadband	0.3°
P-factor/Counter Rudder	1.0°
Total rudder amount	5.3°

Range: 0 to 10° in 0.1° increments

Default: OFF

Turn mode

This allows for the selection of Rate of Turn (ROT) steering or Radius (RAD) steering.

When ROT steering is selected, **Rate of Turn** and **W Rate of Turn** are shown in the Settings menu.

If RAD steering is selected, **Radius** and **W Radius** are shown.

Default: ROT

Rate of Turn

The **Rate of Turn** sets the turning speed of the vessel used by the autopilot during large turns.

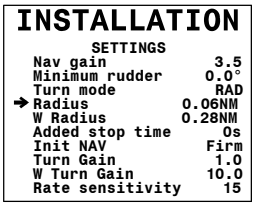
Range: 5°/minute to 720°/minute.

Default: Dependent on boat length.

W Rate of Turn

As for **Rate of Turn** above but applies for the Work-modes.

Radius



This sets the size of the turning circle for the vessel used by the autopilot during large turns.

Range: 0.01 to 0.99 nautical mile.

Default: Calculated from default Rate of Turn

W Radius

As for **Radius** above but applies for the Work-modes.

Added stop time

On larger vessels (typically above 300') or quickly turning small boats, the counter rudder may be insufficient to avoid overshooting large turns. The **Added stop time** parameter is used to stop a turn earlier to avoid overshoot.

Range: 0 to 60 seconds

Default: 0 seconds.

Init NAV

Sets a firm or soft approach to the rhumb line when entering the NAV mode at the first leg. The approach angle is dependant (adaptive) on the distance (XTE) from the rhumb line and the boat speed.

Range: Soft - Firm

Default: Firm

Turn Gain

Turn gain determines the initial rudder command when turning in AUTO and NAV modes.

Increase this value if the amount of rudder is too small when starting a turn.

Range: 1-320

Default value is set according to **Boat length** and **Set rate of turn** in the Installation Seatrial Menu.

W Turn Gain

W Turn gain determines the initial rudder command when turning in WORK modes.

Increase this value if the amount of rudder is too small when starting a turn.

Range: 1-320

Default value is set according to **Boat length** and **Set Rate of Turn** in the Installation Seatrial Menu.

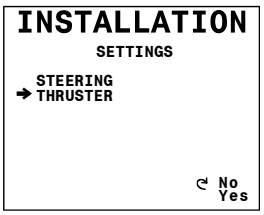
Rate Sensitivity

This parameter determines how sensitive the **Rate of turn** calculation is for changes in the heading signal. The default setting will fit most vessels. For vessels that can turn quickly and have a stable heading compass (high performance compass), the setting should be reduced if the vessel tends to overshoot, even with a high setting of counter rudder. For a slowly turning vessel with noisy compass and unstable **Rate of turn**, the value could be increased.

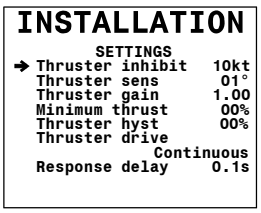
Range: 5 - 25.

Default: 15.

Thruster



Select Thruster in the Settings menu by pressing the (STBD) button and confirm this by rotating the course knob clockwise (only available when Thruster is selected for steering).



Thruster inhibit

Thruster inhibit is a feature that will block the thruster from running above a set inhibit speed of the boat. It is a safety feature to prevent, especially electrical on/off thrusters, from overheating if out of water on for instance a planning boat or in rough weather. **"No thruster response"** alarm will be given when passing the set limit.

Thruster inhibit will not apply when Man speed source is selected, only Log or SOG.

Range: 1 – 99 knots.

Default: 10 knots.

Thruster sensitivity

The **Thruster sens** determines how many degrees the vessel must deviate from the set course before a thruster command is given. As the vessel deviates from its heading, the thruster will push the vessel back. A higher value will reduce the thruster activity and extend the lifetime, especially for on/off thrusters.

If the thruster commands are hunting from side to side, the set value for **Thruster sens** may be too low.

If a low value for **Thruster sens** is needed, consider reducing **Thruster gain** (ref. page 90) to avoid hunting.

Range: Continuous thrusters 0° to 30° in 1° increments
On/off thrusters 3° to 30° in 1° increments.

Default: 1° for continuous thrusters, 5° for on/off thrusters.

Thruster gain

(Only applicable for Continuous and Danfoss thrusters)

Since a continuous type thruster can be operated both in **"Continuous"** and **"Adaptive on/off"** mode (ref. Thruster Drive setting, page 92) the **Thruster gain** parameter is dual. The parameter associated to the thruster drive mode setting will be the one displayed and adjusted.

When operating in **“Continuous”** mode, the thruster gain setting determines the power from the thruster versus heading error. For higher values, the power increases with the same error signal. If the vessel tends to oscillate around set heading, the value should be decreased. If the vessel has a slow approach to set heading, the value should be increased.

When operating in **“Adaptive on/off”** mode, the setting determines the fixed power from the thruster. Higher value gives more power. Some thrusters may be so powerful that even the shortest command makes the vessel to overshoot, especially at low setting of **Thruster sens**. If so the **Thruster gain** must be reduced. If the power is too low for the vessel to regain heading within reasonable time, the setting should be increased.

Range: 0.05 to 2.00

Default: 1 for Continuous thrusters

2 for Adaptive on/off operation
(Ref. Thruster Drive Setting, page 92)

Minimum thrust

(Only applicable for Continuous and Danfoss thrusters)

The **Minimum thrust** determines the amount of power (in % of maximum control signal) that is applied as "first command signal". (Refer to page 71)

Range: 0 to 50% in 1% increments.

Default: 0%.

Thruster hyst

(Only applicable for Continuous and Danfoss thrusters)

When applying a command signal to a proportional valve, a certain amount of deadband may occur, dependant on the directional change of the command. Therefore, a certain “extra” menu-adjustable command signal is generated and either added or subtracted to the command signal in order to compensate for the deadband. Hence the command signal gives the required power without the “loss of deadband signal”.

Range: 0 to 10% in 1% increments.

Default: 0%.

Thruster Drive

(Only applicable for Continuous and Danfoss thrusters)

For On/Off thrusters, it is important to keep thruster activity to a minimum. TI51 therefore has a feature that adaptively adjusts the length of each thruster command to bring the vessel back on heading without over- or undershoot.

When setting **Thruster drive** to “Adaptive on/off”, this feature will also apply for continuously type thrusters in all Work modes (not Follow Up). For operations where the **Thruster sens** can be of some degrees, on/off adaptively will reduce activity also for continuous type thrusters.

Refer also to the **Thruster gain** setting for optional performance.

Default: Continuous

Response delay

(Only applicable for Continuous and Danfoss thrusters)

This parameter determines the slope-time of the start/stop signal to the thruster. Increased value will give softer start/stop and less wear of the thruster. Big powerful thrusters normally need a longer start time than small rapid thrusters.

Range: 0-2 seconds

Default: 1 second

SETTINGS

Displayed parameter	**Boat type (Default settings)**			**Own boat**	
Dockside Menu	Displacement	Planing	Waterjet	Autotune	Manual
Master Operation	No	No	No		
Boat length	0-50 feet	0-50 feet	0-50 feet		
Drive unit voltage	12V	12V	12V		
Rudder limit	10°	10°	10°		
Rudder deadband	AUTO	AUTO	AUTO		
Thruster	- - - -	- - - -	- - - -		
Settings Menu					
W Init rudder	Actual	Actual	Actual		
W Autotrim	Yes	Yes	Yes		
Autotrim	48 sec	40 sec	40 sec		
Course adj.	1°	1°	1°		
Compass diff.	10°	10°	10°		
Off heading lim	10°	10°	10°		
Drive engage	Bypass/clutch				
Drive type	- - - -	- - - -	- - - -		
Drive out	50%	50%	50%		
Prop. gain	13	13	13		
Seastate	AUTO	AUTO	AUTO		
Rudder	0.50	0.30	0.30		
Counter rudder	0.90	0.90	0.90		
W Seastate	AUTO	AUTO	AUTO		
W Rudder	0.75	0.45	0.45		
W Count Rudder	1.40	1.40	1.40		
W Rudder limit	10°	10°	10°		
Cruising speed	15kt	15kt	15kt		
Speed response	0.00	0.00	0.00		
Transition speed	OFF	OFF	OFF		
Nav gain	3.5	3.5	3.5		
Minimum rudder	0.0°	0.0°	0.0°		
Turn mode	ROT	ROT	ROT		
Rate Of Turn	240°/min	240°/min	240°/min		
W Rate Of Turn	240°/min	240°/min	240°/min		
Added stop time	0s	0s	0s		
Init NAV	Firm	Firm	Firm		
Turn gain	38	38	38		
W Turn gain	38	38	38		
Rate sensitivity	15	15	15		
Thruster inhibit	10 kt	10 kt	10 kt		
Thruster sens	1°/5°	1°/5°	1°/5°		
Thruster gain — Continuous	1.0	1.0	1.0		
Thruster gain — Adaptive on/ off	2.0	2.0	2.0		
Minimum thrust	00	00	00		
Thruster hyst	00	00	00		
Thruster drive	Continuous	Continuous	Continuous		
Response delay	1.0 sec	1.0 sec	1.0 sec		

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5 SPARE PARTS LIST

	AP50 Control Unit
20214045	AP50 Control Unit with accessories
20212247	Installation Accessories
20212130	Mounting Bracket ass’y
20211819	Protection Cover
20212213	AP50 Front Housing Ass’y
20211868	AP50 Board Ass'y
20212189	PROM (programmed) V..R..
	AP51 Remote Control
20214052	AP51 Remote Control with accessories
22086276	Mounting Kit
20212015	AP51 Front Housing Ass’y
22086383	Cable with Gasket
20212031	AP51 Board Ass'y
20212007	AP51 PROM (programmed) V..R..
	JP21 Jack Point
22086433	JP21 Jack Point
22086557	JP21 Cover Ass’y & o-ring
	JD5X distribution units
20126819	JD50 Distribution Unit 24V DC
20126827	JD51 Distribution Unit 110V DC
20126835	JD52 Distribution Unit 220V AC
20126843	JD53 Distribution Unit Analog
20212528	J50 Power Board
20211918	J50 Main Board
20125175	D9X Solid State Board, 24V DC
20125423	D9X Solid State Board, 110V DC
20125720	D9X Solid State Board, 110/220V AC
20214292	JD5X Dual Analog Board
20211934	PROM (Main Board)
	RF45X Rudder Feedback Unit
22011415	RF45X Rudder Feedback Unit
22011217	Mounting Kit
22011258	RF45X PCB Ass’y with Potentiometer
22011183	RF45 Transmission Link Ass’y
22011431	RF45X Ball Joint Ass’y

22504039	Transmission Lever
	RF14XU Rudder Feedback Unit
22506950	RF14XU Rudder Feedback Unit
22501605	Electronic XU Module
44118388	Potentiometer 5 Kohm
	RF Standard Transmission Link
22504005	RF Standard Transmission Link complete
22504021	Transmission Lever (Ø12mm)
44132306	Ball Joint 8mm, Stainless Steel
	RC25 Rate compass
22084438	RC25 Rate Compass with accessories
22084370	RC25 PCB Ass'y
	CD100A Course Detector
20106688	CD100A Course Detector
20106696	Cable, 7m
	CD109 Course Detector
20121257	CD109 Course Detector with Tripod Holder
20120721	CD109 Course Detector
22331997	Tripod Holder
20120853	AMP Connector with bracket
	CDI35 Course Detector Interface
22087001	CDI35 Course Detector Interface w/accessories
22081152	CDI35 PCB Ass'y
	NI300X NMEA Interface
22089536	NI300X NMEA Interface
22081913	NI300X PCB Ass'y
	S35 NFU Steering Lever
23241227	S35 NFU Steering Lever
23241144	S35 PCB Ass'y
44125599	Micro Switch
23240096	Spring
44190114	Gasket
44140796	Cable Gland

S9 Steering Lever

23601800	S9 Non Follow Up steering lever
23601859	Lever with actuator shaft
23602089	S9 Service Kit (Springs and Grease)

R3000X Remote Control

22022446	R3000X Remote Control
20184552	Mounting Kit
20184545	PCB Ass’y
20184578	Cable
20184586	Front Housing
22022396	Front Panel

Robnet cables and connectors

22081145	Robnet Cable 15 m (49’) with one male connector
20191607	Robnet Cable 7m (23') with Male Connectors
20191615	Robnet Cable 15m (49') with Male Connectors
20192266	Robnet Extension Cable 10m (33') with Male and Female Connector
44138048	Robnet Cable (bulk)
22082697	Male Connector Ass’y
22082705	Female Connector Ass’y

Tools

44139707	Key for Lock Ring on Robnet Receptacles
44139806	PROM Extraction Tool
44161792	Robnet Pin Extraction Tool (for crimp type connectors)

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6 TECHNICAL SPECIFICATIONS

6.1 AP50 Autopilot System

Boat type:..... Power

Steering system types: ..... Hydraulic, mechanical, solenoids

Inter-unit connection: .....Robnet network or two-wire supply/data

Number of Robnet units in a system: ..... Refer to page 31 and 32

System ON/OFF: .....From control units/master unit

Supply voltage:.....24-32 VDC –10%/+30%

Power consumption: .....Dependent on system configuration (See 6.4 Distribution Unit)

EMC protection:.....EN60945: 1996-11

Performance:...IMO A.822(19), ISO/CD16329.2, IMO MSC(64)67, ISO 11674:2000(E)

Rate of turn: ..... Within ±10% of preset value or 3°/min. (Ref. ISO 11674: 4.3.7)

Heading indication error:.....<0.5° (Ref. ISO 11674: 4.3.5)

Heading stability:.....Within ±1° (Ref. ISO 11674: 4.3.13)

Automatic Steering control:

Rudder Drive: ..... Proportional pump, solenoid on/off, proportional valve, analog

Parameter selection:.....Automatic with manual override

Sea state control:.....Adaptive sea state filter

Language selection: English, German, French, Spanish, Italian, Dutch, Swedish, Norwegian.

Electronic Interface:

Navigation interface: .....Standard (NMEA 0183)

NMEA input/output ports:Max. 6 (see Distribution units and NI300X specifications)

Refer to NMEA Sentences table page 113 for data.

Heading output: ..... Anritsu and Furuno radar display (clock/data)

Heading sensors:.....Gyrocompass, Fluxgate compass, Magnetic compass

NMEA Compasses, Transmitting Heading Device (THD)

Course selection:.....Rotary course knob and buttons

Alarms: ..... Audible and visual, external optional

Alarm modes: ..... Compass difference, off heading, system failures, overload

Steering modes: ..... STANDBY, Non-follow-up, Follow-up, AUTO, AUTO-WORK, NAV, NAV-WORK

Special turn modes: .....DODGE, U-Turn, C-Turn (5-720°/min.)

System selector autopilot/main steering system:.....Potential free contact

6.2 AP50 Control Unit

Dimensions: ..... See Figure 6-1
Weight: ..... 0.9 kg (2.0 lbs.)
Material: ..... Epoxy coated aluminum
Supply: ..... 12-32 VDC –10%/+30% via Robnet
Power consumption: ..... 3 W
Environmental Protection: ..... IP56 (when panel-mounted)
Safe distance to compass: ..... 0.35 m (1.0 ft.)
Color: ..... Black
Temperature:
- Operating: ..... –25 to +55°C (–13 to +130°F)
- Storage: ..... –30 to +70°C (–22 to +158°F)

Display:
- Type: ..... Backlit LCD matrix
- Resolution: ..... 160 x 128 pixels

Illumination: ..... Adjustable in 10 grades
Mounting: ..... Panel mount or bracket mount (optional)
Cable: ..... Robnet cable 15 m (49 ft.) with one male connector

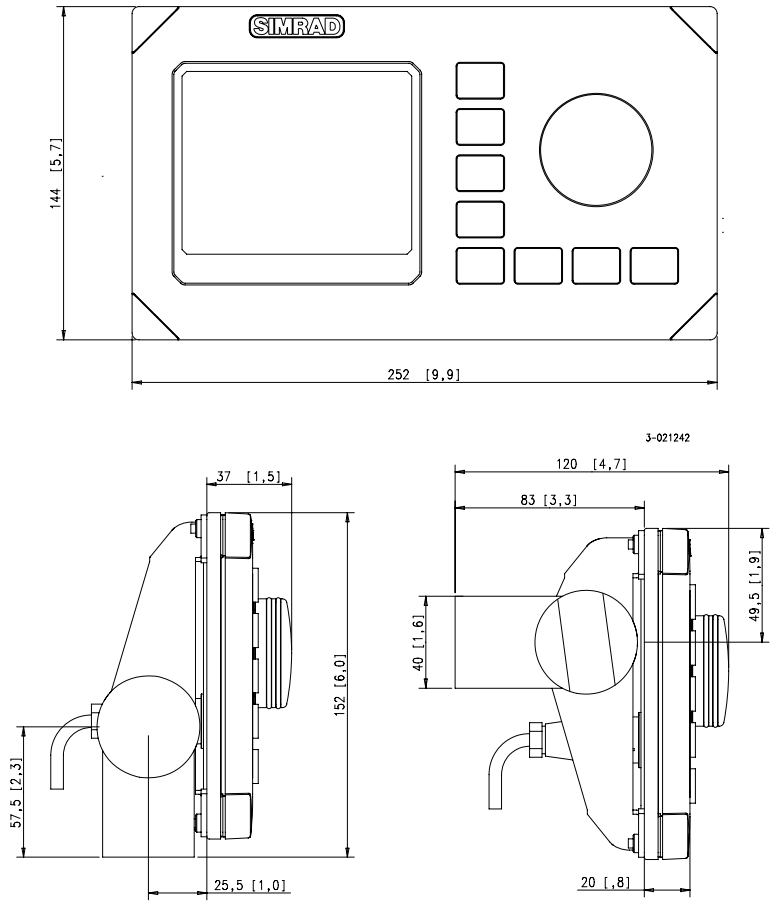


Figure 6-1 AP50 Control Unit Dimensions

6.3 AP51 Remote Control

Dimensions: ..... See Figure 6-2
Weight: ..... 0.57 kg (1.25 lbs.)
Material: ..... PC-ABS
Supply ..... 12-32 VDC –10%/+30% via Robnet
Power consumption ..... 3 W
Environmental Protection: IP56
Safe distance to compass: ..... 0.35 m (1.0 ft.)
Color: ..... Black
Temperature:
- Operating: ..... –25 to +55°C (–13 to +130°F)
- Storage: ..... –30 to +70°C (–22 to +158°F)

Display:
- Type: ..... Backlit LCD matrix
- Resolution: ..... 80 x 32 pixels

Illumination: ..... Adjustable in 10 grades
Mounting: ..... Handheld or placed in a fixed, bracket-mount
Cable: ..... 7m (23 ft.) Robnet cable with air tube and one male connector

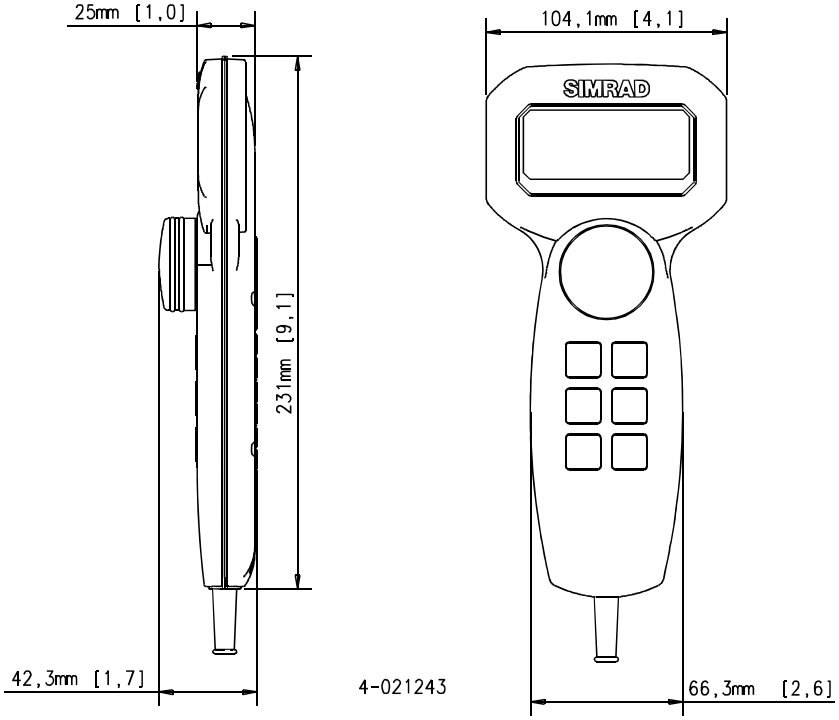


Figure 6-2 AP51 Remote Control Dimensions

6.4 JD5X Distribution Units

Dimensions: ..... See *Figure 6-3*
Weight: ..... 3.5 kg (7.7 lbs.)
Material: ..... Anodized aluminum
Supply voltage: ..... 24 VDC –10%/+30%
Reverse voltage protection ..... Yes
Environmental Protection (IEC60945 Rain and spray protected): IP44
Power consumption: ..... 5 Watt (electronics only)
Robnet Supply: ..... 2.5A (automatic fused)
Drive engage (Bypass/Clutch, Auto, Handshake): ..... Max 1.5 A
Solenoids, externally supplied ..... JD5X: Maximum 3 A
Motor/solenoid drive: ..... JD5X: 10 A continuous, 20 A for 5 seconds
Vbat output: ..... 2.5 A (automatic fused)
Safe distance to compass: ..... 1.5 m (5 ft.)
Temperature range:
Operation: ..... –25 to +55°C (–13 to +130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Heading Sensor input: ..... Composite pulse width modulated
Rudder feedback input: ..... Frequency signal, 3400 Hz, 20 Hz/degree
Rudder feedback units: ..... RF45X or RF14XU
FU/NFU control input ..... Yes
NMEA input/output ports: ..... Two
External Alarm: ..... Open collector 0.75 A (automatic fused)
Mounting: ..... Bulkhead-mount
System selector Autopilot/Main steering system input: ..... Potential free contact
Heading output: Simrad and Furuno radar display (clock/data; 0-5 V, 10 mA, 50 msec.)

Steering gear interface:

JD50 Distribution Unit:
Solid state output: ..... Switching low DC (19-40 V) single channel. 3 A.

JD51 Distribution Unit:
Solid state output: ..... Switching high DC (110 V) single channel. 1 A.

JD52 Distribution Unit:
Solid state output: ..... Switching high/low AC (110-220 V) single channel. 1 A.

JD53 Distribution Unit:
Analog voltage control, internal supply: ..... Control range ±10 V, max. 5 mA
Galvanic isolated
Analog voltage control, external supply: ..... Uext 5-24 VDC,
max. contol range 1.5 V to Uext – 1.5 V, max. 5 mA

Analog current control: ..... 4-20 mA output
Dual autopilot On and Mode output: ... Potential free contacts, max 1 A at 30 VDC

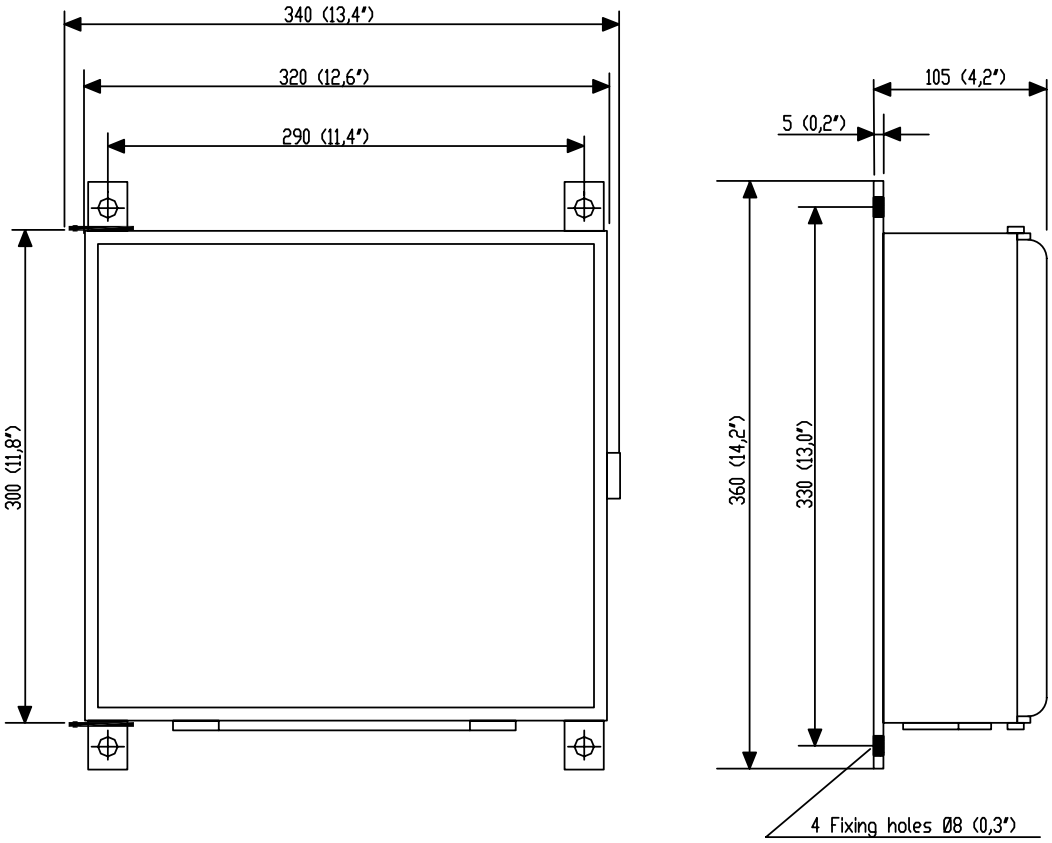


Figure 6-3 JD5X Distribution Unit, Dimensions

6.5 RC25 Rate Compass

Dimensions: ..... See Figure 6-4
Weight: ..... 0.9 kg (2.0 lbs.)
Power consumption: ..... 0.9 watts
Supply and interface: ..... Robnet
Environmental Protection: IP56
Material: ..... White ABS
Temperature range:
Operation: ..... 0 to +55°C (+32 to + 130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Mounting: ..... Deck-mount or bulkhead-mount
Cable: ..... 15 m (49 ft.) Robnet cable with connector
Automatic Performance:
Calibration: ..... Automatically activated by control head

Rate sensor stabilized heading output

Accuracy: ..... <1.25° rms (after calibration)

Repeatability: ..... <0.2° rms

Roll/Pitch: ..... ± 35°

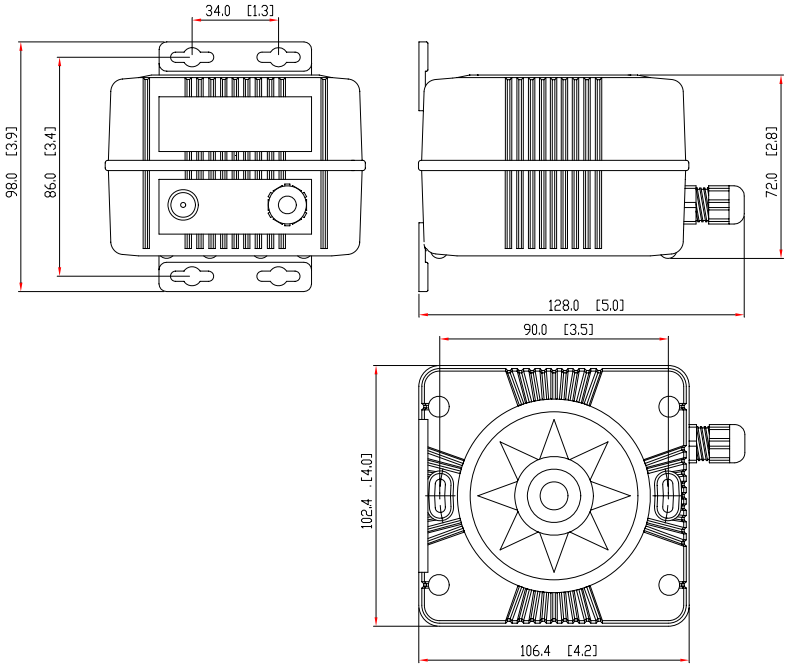


Figure 6-4 RC25 Rate Compass and CDI35 Course Detector Interface Dimensions

6.6 CDI35 Course Detector Interface

Dimensions: ..... See Figure 6-4

Weight: ..... 0.9 kg including cable (2.0 lbs.)

Power consumption: ..... 0.9 W

Supply and output: ..... Polarity-independent 2-wire supply with superimposed pulse width modulation

Environmental Protection: IP56

Safe distance to compass: ..... 0.1 m (0.3 ft.)

Material: ..... Black ABS

Temperature range:

Operation: ..... –25 to +55°C (–13 to + 130°F)

Storage: ..... –30 to +70°C (–22 to +158°F)

Mounting: ..... Deck-mount or bulkhead-mount

Cable: ..... 15 m (49 ft.) single twisted pair, shielded

Automatic Performance:

Calibration: ..... Automatically activated by control head

Repeatability: ..... ± 0.5°

Accuracy: ..... ± 1,0° after calibration (not including errors from course detector)

6.7 CD100A Course Detector

Dimensions: ..... See Figure 6-5

Weight: ..... 0.3 kg (0.7 lbs.) including cable

Environmental Protection: IP56

Temperature range:

Operation: ..... –25 to +55°C (–13 to + 130°F)

Storage: ..... –30 to +70°C (–22 to +158°F)

Mounting: ..... Attached to compass by screw or by tripod holder

Cable length: ..... 7 m (23 ft.), no plug included

6.8 CD109 Course Detector

Dimensions: ..... See Figure 6-5

Weight: ..... 0.3 kg (0.7 lbs.) including cable

Environmental Protection: IP56

Temperature range:

Operation: ..... –25 to +55°C (–13 to + 130°F)

Storage: ..... –30 to +70°C (–22 to +158°F)

Mounting: ..... Attached to compass by screw or by tripod holder

Cable length: ..... 1 m (3 ft.) with AMP plug

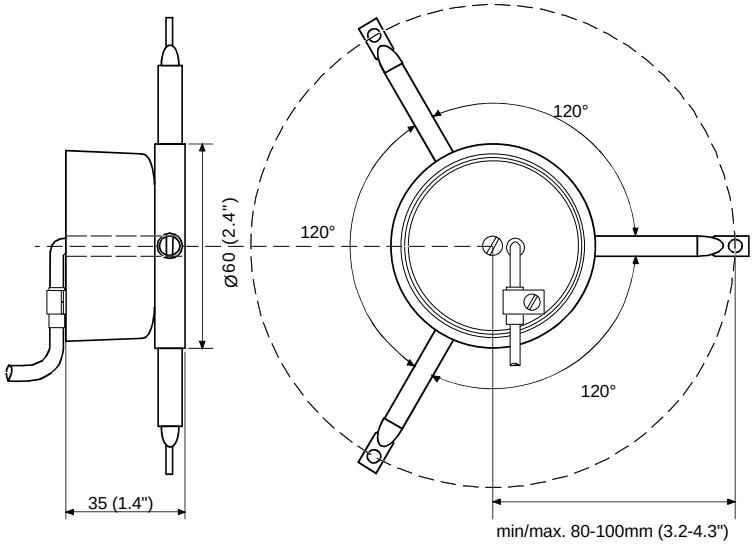


Figure 6-5 CD100A/CD109 Course Detector Dimensions

6.9 RF45X Rudder Feedback Unit

Dimensions: ..... See Figure 6-6, Figure 6-8 and Figure 2-6
Weight: ..... 1,0 kg (2,2 lbs.)
Material: ..... Polyacetal (POM)
Supply voltage: ..... 12-24 VDC –10%/+30%, system supplied
Environmental Protection: IP56
Temperature range:
Operation: ..... –25 to +55°C (–13 to +130°F)
Storage: ..... –30 to +70°C (–22 to + 158°F)
Cable: ..... 2 m (6 ft.)
Rudder angle: ..... ± 45°
Output signal: ..... Polarity-independent frequency signal
Frequency resolution: ..... Center: 3400 Hz, 20 Hz/degree of change
Linearity: ..... ± 3° up to 45° of rudder
Current output for rudder angle indicator (only for stand-alone system).. 0.1mA - 1.1mA
Number of indicators (only for stand-alone system): ..... 5 in series

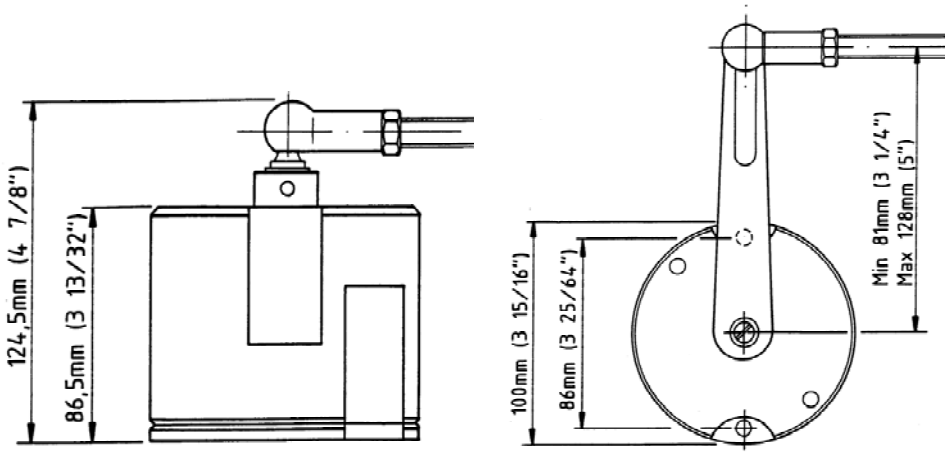


Figure 6-6 RF45X Rudder Feedback Unit Dimensions

6.10 RF14XU Rudder Feedback Unit

Dimensions: ..... See Figure 6-7
Weight: ..... 2,8 kg (4,9 lbs.)
Material: ..... Reinforced glass fibre polyester
Environmental Protection: IP56
Ambient temperature:
Operation: ..... –15 - +55°C (+5 to +130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Supply voltage: ..... 24VDC –10%/+30%

Voltage output: .....Operating voltage/2 ±9V
Frequency output: .....3400Hz (midships reference)
Port: +20Hz/degree, Stbd: –20Hz/degree
Capacity: .....5 indicators in parallel
Rudder angle: ..... ±45 ° (Changeable to 60, 70 or 90°)
Limit switches: .....Two sets, individual adjustable from ±5 to ±160°

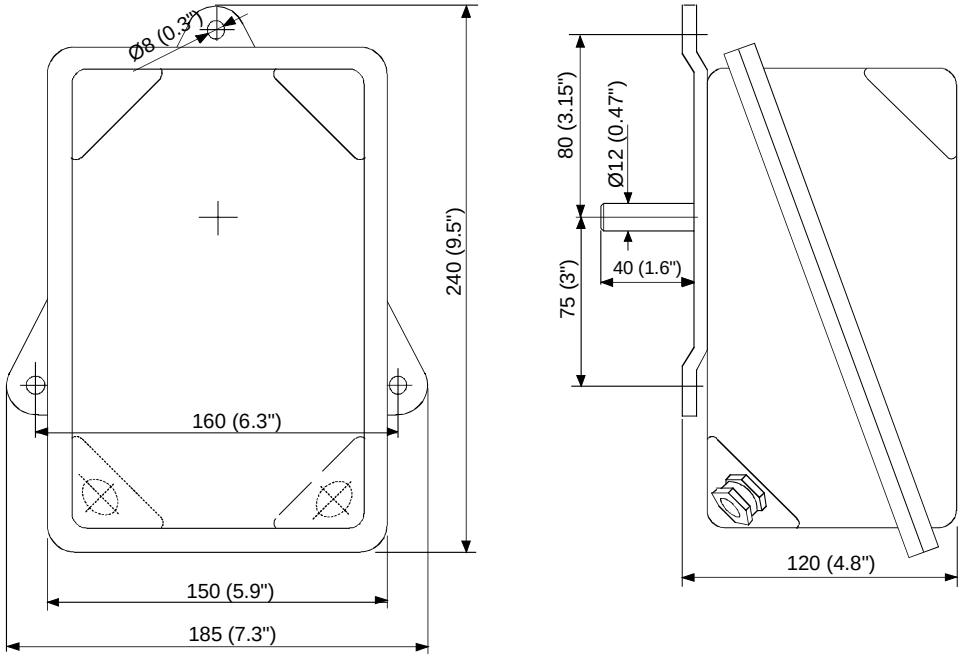


Figure 6-7 RF14XU Rudder Feedback Unit Dimensions

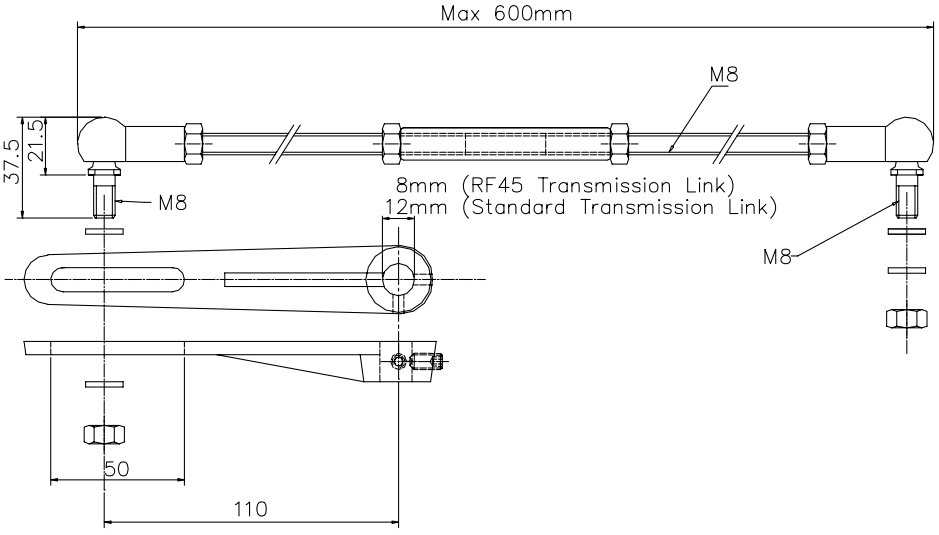


Figure 6-8
RF Standard Transmission Link - dimensions

6.11 NI300X NMEA Interface

Dimensions: ..... See Figure 6-9
Weight: ..... 0.9 kg (2.0 lbs.)
Material: ..... Epoxy coated aluminum
Environmental Protection: IP44
Supply and interface: ..... Robnet, 2 connectors
Power consumption: ..... 3 W
Safe distance to magnetic compass: ..... 0.3 m (1 ft.)
Temperature range:
Operation: ..... –25 to +55°C (–13 to +130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Mounting: ..... Bulkhead mount
Cable inlets: ..... Rubber glands for cable diameter 10-14 mm
NMEA183 input/output: ..... 4 ports, max. output load 20 mA
Heading output: .... Simrad (Anritsu) and Furuno radar display (clock/data; 0-5V, 10mA, 50 msec.)
NMEA instrument supply: ..... 12 VDC, max 0.25A
External alarm: ..... Potential free contact

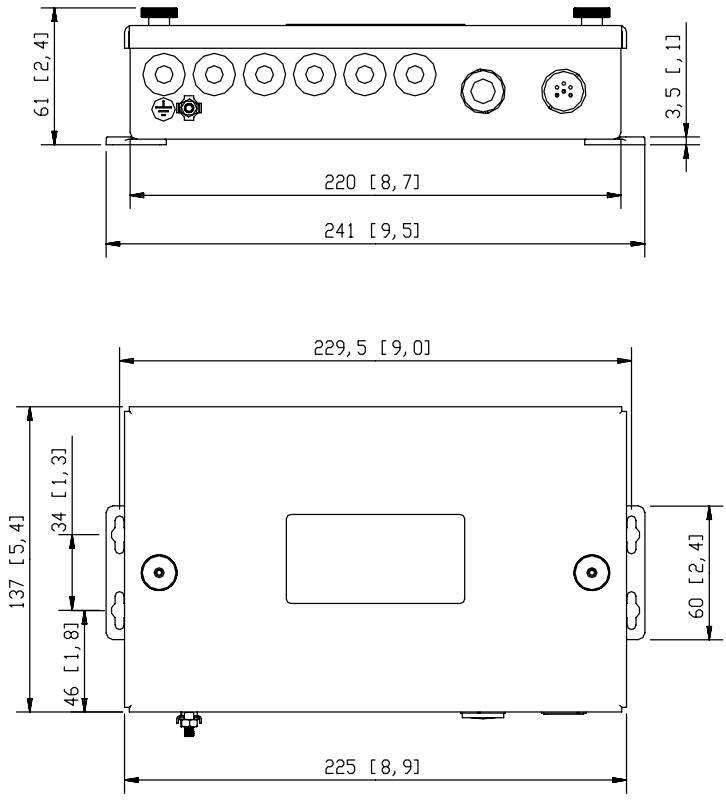


Figure 6-9 GI51, TI51, AD50 and NI300X Dimensions

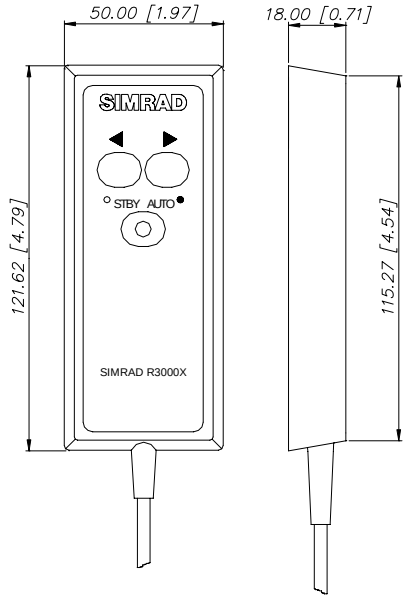
6.12 TI51 Thruster Interface

Dimensions: ..... See Figure 6-9
Weight: ..... 0,8 kg (1.8 lbs)
Material: ..... Epoxy coated aluminium
Environmental Protection: IP44
Supply and interface: ..... Robnet, 2 connectors
Cable inlets: ..... Rubber glands for cable diam. 10-14 mm
Mounting: ..... Bulkhead mount
Compass safe distance: ..... 0.2 m (0.7 ft)
Temperature range:
- Operation: ..... –25 to +55°C (–13 to +130°F)
- Storage: ..... –30 to +70°C (–22 to +158°F)

Thruster drive interface:
- On/Off solenoids: ..... Port/stbd on/off, open collector, galvanic isolated, external common plus or minus, 3A max.
- Sauer Danfoss PVEM: ..... Nominal U_{DC}=12/24V, I=0.25/0.5mA, neutral 0.5*Un, control range 0.25*U_{DC} to 0.75*U_{DC}, valve saturated for<0.25*U_{DC} or >0.75*U_{DC}.
- Analog voltage control, internal supply: ..... Control range ±10V, max. 5 mA, galvanic isolated
- Analog voltage control, external supply: ..... U_{DC} 5-24VDC, control range 0- U_{DC} or ±U_{DC}/2, max. 5 mA
- PWM open collector for proportional directional control, external supply:
  - Control range off to full on: ..... 12-24VDC, max. 1,5A
  - Dither: ..... Off or 70 -400 Hz, 0-10% amplitude.
- Analog current control: ..... 4 – 20 mA

Thruster enable output/Take command pulse: ..... Open collector, external or internal +, max 500 mA.
The internal +12V output is limited to 100mA and may be used for an external relay operated by Hi/Lo output to switch thruster control signal between autopilot and external manual control.

6.13 R3000X Remote Control



Dimensions: ..... See Figure 6-10
Weight: ..... 0.4 kg (0.9 lbs.)
Material: ..... Epoxy-coated aluminum
Environmental Protection IP56
Safe distance to compass: ..... 0.15 m (0.5 ft.)
Temperature range:
Operating: ..... –25 to +55°C (–13 to +130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Cable: ..... 7 m (23 ft.), shielded
Mounting bracket: ..... Supplied

Figure 6-10 R3000X Remote Dimensions

6.14 S9 Steering Lever

Dimensions: ..... See Figure 6-11
Weight: ..... 2.8 kg (6.2 lbs)
Environmental Protection: IP56
Temperature range:
Operation: ..... –25 - +55°C (–13 to +130°F)
Storage: ..... –30 to +70°C (–22 to +158°F)
Safe distance to compass: ..... 0.15 m (0.5’)
Max. inductive load: .....4A/24V DC, 0.6A/110V DC, 0.3A/220V DC, 10A/AC

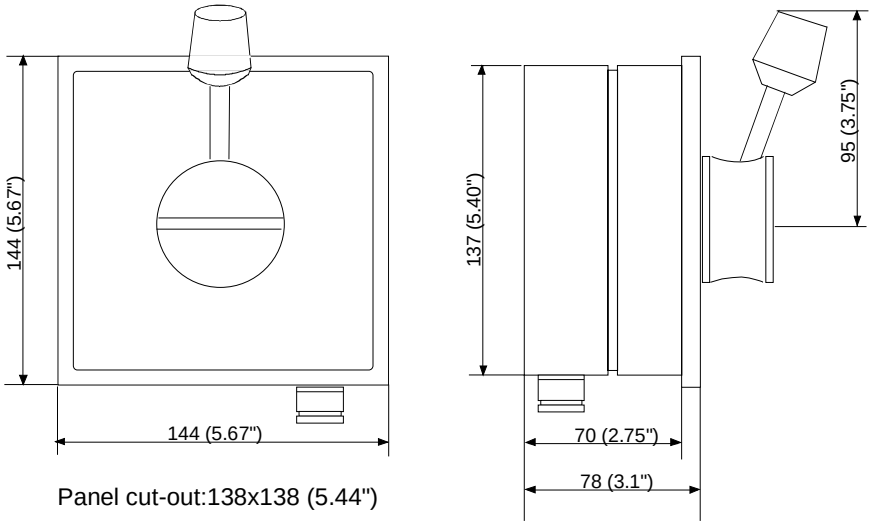


Figure 6-11 S9 Steering Lever - Dimensions

6.15 Environmental Protection

Each part of a Simrad autopilot system has a two-digit IP protection code.

The IP rating is a method to classify the degree of protection against solid objects, water ingress, and impact afforded by electrical equipment and enclosures. The system is recognized in most European countries and is set out in a number of British and European standards.

The first code number describes the protection against solid objects and the second number describes the protection against liquids.

FIRST NUMBER Protection against solid objects		**SECOND NUMBER** Protection against liquids	
IP	**TESTS**	**IP**	**TESTS**
0	No protection	0	No protection
1	Protection against solid objects up to 50 mm, e.g. accidental touch by hands.	1	Protected against vertically falling drops of water (e.g. condensation).
2	Protection against solid objects up to 12 mm, e.g. fingers.	2	Protected against direct sprays of water up to 15° from the vertical.
3	Protection against solid objects over 2.5 mm (tools + wires)	3	Protected against sprays to 60° from the vertical.
4	Protection against solid objects over 1 mm (tools + wires + small wires)	4	Protected against water sprayed from any direction - limited ingress permitted.
5	Protection against dust - limited ingress (no harmful deposit)	5	Protected against low-pressure jets of water from all directions - limited ingress permitted.
6	Totally protected against dust	6	Protected against strong jets of water, e.g. for use on ship decks - limited ingress permitted.
		7	Protected against the effects of immersion between 15 cm and 1 m.
		8	Protected against long periods of immersion under pressure.

6.16 NMEA Sentences

See table next page.

AP50 system, NMEA 183 messages (applies for J50 and NI300X sw release V1R2 onwards)																																	Missing data timeout (s)		
Sentence Formatter mnemonic code Bold = recommended navigator/instr. output for autopilot *Italic* = IMO designated ( ) = not for new designs			(APA)	**APB**	BOD	BWW	**BWC**	BWR	RMB	XTE	XTR	GGA	GLL	RMA	**RMC**	VTG	***VBW***	VHW	(DBK)	DBT	***DPT***	**MWV**	(VWR)	***HDT***	***HDG***	*ROT*	(HDM)	*RSA*	HSC	*HTD*	**Remarks:**	TX stop	Alarm	New mess. priority
Data source: (A=autop., C=comp., I=instr. sensor, N=navigator)			N	N	N	N	N	N	N	N	N	N	N	N	N	N	I	I	I	I	I	I	I	C	C	I,A	C	A	A	A				
Accept. condition: No nav/pos (n/p) flag warning			n	n	n	n	n*	n*	n	n	n	p	p	p	p	p*															*Rejected if "Data not valid" flg (NMEA183 V2.30 onwards)			
Status flag	n/p= nav/pos data warning		n	n					n	n	n	p*	p	p	p																* DGPS if flag=2	10		
Nav Data	Destination wp position						2	1	3																							10		45
	Destination wp ident.		6	7	5	1	3	2	4																							10		45
	Origin wp ident.				3	1			2																							10		45
	Bearing wp-wp, T		3	4	2	1																										10		45
	Bearing wp-wp, M		3	4	2	1																										10		45
	Bearing pos-wp, T			4			2	1	3																							10		45
	Bearing pos-wp, M			3			2	1																								10		45
	Distance pos-wp						2	1	3																							10		45
	XTE		4	5					2	3	1																					10-20	6	20
Position Data	Present position Lat, Long											4	1	2	3																	20		60
	COG, T													1	2	3																20		45
	COG, M															1																20		45
	Magnetic variation				3	2								5	6	4									1*						*Only applicable if received on set nav. source ch.	10		70
Speed Data	Speed over ground (SOG)													1	2	3																2	15	45
	Speed through water (LOG)																2*	1													* Longitudinal field	na	15	45
Depth Data	Depth relative to transducer																		1	2	3											na		45
Wind Data	Apparent wind angle																					2	1									na		45
	Apparent wind speed																					2	1									na		45
Heading Data	Compass heading, T																	1**						3	2*					TX	* Calculated as magn. heading + magvar.	2	4	2
	Compass heading, M																	1							3		2			TX	** Relative (geared synch./step) if PSIM identifier	2	4	2
	Rate of turn*																									TX*					*TI, AG or II Talker Ident (ref. Inst. Manual)			
Rudder Data	Rudder angle																											TX				10		
	Rudder command																													TX		∞		
	Rudder angle limit																													TX		∞		
	Rudder status																													TX		∞		
Steering control	Commanded heading T/M																												TX	TX		∞		
	Commanded ROT/radius																													TX		∞		
	Selected steering mode																													TX		∞		
	Off heading limit																													TX		∞		
	Off heading status																													TX		∞		
RX: J50-1, NI300X	x = input messages accepted		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x*	x	x	x	x	x								* J50-1 will only read speed, not heading			
J50-2			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x							
GI51																	x*	x*						x	x		x				* Option switch to be set for NMEA speed reading			
TX: J50-1, 1Hz Installation setup	TX rate in Hz					.1	.1		.5	.2			.5		.5	.5								1*	1*		1	1	.1		* Either true or magn. is calc. value if magvar is available			
J50-1, 5Hz Installation setup						.1	.1		.5	.2			.5		.5	.5								5*	5*		1	5	.1					
J50-1, VDR Installation setup																												5		5				
J50-2																								10*	10*		1	5	.1		* HDT if true, HDG if magn. steering compass			
NI300X						.1	.1		.5	.2			.5		.5	.5								1*	1*		1	1	.1		* Either true or magn. is calc. value if magvar is available			
GI51																		1**						10*	10*	1					*Absolute head. only.; **For rel. head: PSIM talker id. and 10Hz			
GI50																		10*													* PS talker identifier (relative. heading)			
Normal sentence length (bytes)			46	66	45	45	78	78	82	29	23	78	46	67	72	43	47	41	36	36	28	30	40	19	32	18	19	27	27	82				
Max sentence transmission rate (Hz)			10	7	11	11	6	6	6	17	21	6	10	7	7	11	10	12	13	13	17	16	12	25	15	27	25	18	18	6				

Number gives RX priority (1 is lowest); TX if transmitt only; For * ref. column "Remarks"

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7 TROUBLESHOOTING

Audible and visual alarm is provided for every fault being detected. In the event of an autopilot failure, the AP50's numerous test features will assist you in isolating a probable fault. Refer to the AP50 Operator Manual.

In the unlike event of a failure in the JD5X, observe the status of the different LED's according to the table below.

7.1 Solenoid control

For component references refer to the D9X Solid State Board, Component layout, Figure 2-16.

Display readout	Probable fault	Recommended action
No rudder response	Open solenoid command lines. I.e. LD3/LD4 are lit for rudder commands.	– Check TB16 for correct jumper setting. – Check fuse F1 and F2. – Check correct setting of S4-S7 – Check that LD5 is OFF; if ON check correct setting of HL-jumper or look for short circuit or steering gear solenoid failure.
	Fault on J50 Power board or open internal connection. I.e. LD3/LD4 are <u>not</u> lit for rudder commands.	– Check that solenoid LEDs on J50 Power board are lit when commands are given (ref. page 17). – If OK, check internal wiring from J50 Power board (Solenoid isolated Hi1/Hi2) to D9X TB13 1/2.
	No power to the D9X Solid State Board.	– LD1 to be lit. If not, check correct setting of S1-S3 switch. Check for board supply 26-40V DC between J1-7 and J1-9 (ref. Figure 2-16).
	Defective safe relay function.	– If LD2 is off when LD1 is on; replace board.
	Steering gear not operative or defective rudder feedback.	– Ref. Trouble shooting section in AP50 Operator manual.

7.2 Analog rudder control

For analog rudder control, no rudder angle signal is sensed by the autopilot. Missing rudder response can therefore not be detected immediately and displayed. As described on page 118, this may result in “Vessel of course” alarm although the fault may be in the rudder control system.

For component references refer to the JD5X Analog Board, Component layout, Figure 2-22.

Display readout	Probable fault	Recommended action
No rudder response (Remains in actual mode without any rudder command)	No power to the JD5X Analog board.	Check for 26-40V DC between J1-7 and J1-9 (ref. Figure 2-22).
	Robnet communication to JD5X is broken.	Check connection between the J2 connector on the JD5X board and the Robnet connector on the main computer board, J1-12 to Bus+, J1-14 to Bus–.
	CPU on JD5X Analog board has stopped due to severe power transient, software lockup or defective electronics.	Check LED for “CPU running”. If it alternates with 1 Hz the board operates OK. If the LED is permanently on or off, switch power off and on to restart.
	JD5X Analog Board has been set for wrong operation.	Check correct setting of dip switch SW1 (ref. page 27). If two boards are installed, only one must be set to operate as Analog Interface.
	Improper or missing reference voltage for analog control signal.	Check correct setting of S1 to S4. For voltage control with external reference, check voltage at TB20 and TB22 pin 3 and 4 (ref. Figure 2-18) For ±10V or 4-20mA control check internal ±12V: +12V between S1-left and TB20-2. –12V between S2-left and TB20-2. +12V between S3-left and TB22-2. –12V between S4-left and TB22-2.
	Open analog control line.	Check for correct setting of switch S1 to S4. Check that the LED D700 is on. Measure presence of analog voltage or current signal on relevant terminal list (ref. Figure 2-17 to Figure 2-19).

Display readout	Probable fault	Recommended action
No rudder response (cont'd)	Improper steering gear operation.	Check that the steering gear has been started and set for autopilot operation. If in use, make sure that the ON and MODE signals from JD5X are given correctly (ref. Figure 2-20). Also check for correct setting of switch S6-S9, LED D903 for ON and D904 for MODE.
No rudder cntrl voltage	1. External reference voltage missing for analog rudder control. 2. Internal voltage missing for ±10V or 4-20 mA analog rudder control.	Check reference voltage on Dual Analog Board TB20 and TB22. Wrong setting of S1-S4. Check internal ±12V. Drive 1: +12V between S1-left and TB20-2. –12V between S2-left and TB20-2. Drive 2: +12V between S3-left and TB22-2. –12V between S4-left and TB22-2.
Rudder feedb. failure	Installation settings have been changed from analog rudder control to solenoid systems.	Enter Dockside installation and re-install analog rudder control.

7.3 Failure Mode Effect Analyses

Should a technical fault occur, provisions have been made for safe operation according to the following table:

Cause of failure	**Effect**
Power failure in autopilot supply	Acoustic POWER FAILURE ALARM given (operated by separate alarm supply)
Ship does not respond to rudder command	“Vessel of course” alarm given when off course limit exceeded during transit
Analog board: Processor stop or software lockup	Analog command line open after approx. 1 sec. or signal frozen (depends on setting of switch S6 on the JD53 Dual Analog Board). Watchdog restart after 1.6 seconds. “No rudder response” alarm after 5 sec.
Analog board: Data line or power line open in internal bus cable	After 5 sec: Analog command lines open, signal level frozen. Steering gear Mode1 and Mode2 go off. “No rudder response” alarm
Analog board: Missing reference voltage for rudder control electronics.	“No rudder cntrl voltage” alarm. Analog command lines open, signal level frozen.
Solid state board: Missing supply, blown fuse, broken connection, defect drive electronics.	“No rudder response” alarm.

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9 APPROVALS

9.1 Product compliance schemes

Electronic navigation equipment on boats and ships within the **European Common marked** (EC) are regulated by two main directives:

- Directive 89/336/EC Electromagnetic Compatibility, "EMC directive"
  - This directive is applicable to more or less all boats, including leisure boats. Refer ***CE mark*** section below
- Council Directive 96/98/EC of 20 December 1996 on marine equipment, "Marine directive" or "MED"
  - This directive is valid for ships that come under international conventions such as LL66, Colreg, Marpol, and Solas. Refer to the ***Wheelmark*** section below

The **Marine directive** requirements include the requirements of the **EMC directive**, and a product which comply with the **Marine directive** is therefore automatically also in compliance with **EMC directive**.

CE mark

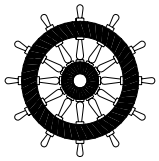
CE

The **CE** mark is placed on a product as the manufacturer's visual identifier that the product meets the requirements of relevant European Directives. The CE mark is mandatory for a wide range of products sold within or exported to the European market, and applies to all Electric- and Electronic equipment.

When the equipment is tested according to the requirements in the Directive 89/336/EEC, the CE marking is applied to the units to symbolize Simrad's Declaration of Conformity with the directive.

The CE declaration for any CE marked unit can be obtained from your Simrad distributor.

Wheelmark



0575/05

The Wheelmark symbol (Mark of Conformity) is an accreditation that is required for equipment placed on board ships for which safety certificates are issued by, or on behalf of, Member States of the European Union.

Before a wheelmark can be affixed to a product, an independent organization appointed by a European national authority (a Notified body) has to undertake conformity assessment, and test reports and a MED-B certificate have to be issued. These test reports and certificates have to be kept by the manufacturer.

The manufacturer is allowed to affix the Wheelmark symbol and issue a declaration of conformity only if the manufacturer also holds a relevant QA certificate (MED-D).

The wheelmark shall be followed by:

- the identification number of the notified body (Det Norske Veritas = 0575) which has performed the conformity assessment procedure and the last two digits of the year in which the mark is affixed.

Note !

When a complete system (e.g. an autopilot system) is wheelmark approved, only the main unit(s) in the system wears the wheelmark symbol. This to avoid the misunderstanding that all standard and optional units in a system retain their wheelmark approval if they are installed in a not approved system. The type examination certificate (MED-B) for the wheelmarked system lists all optional equipment that is part of the wheelmark approval. The EC Declaration of Conformity do also show which units that are part of the approval.

EU's official database (MarED Product Database) contains information about wheelmarked equipment. This database is found on:

http://www.mared.org/

9.2 Certificates

For certificates and CE declarations regarding the AP50 system components, refer to the following pages.

The certificates and CE declarations for any wheel marked equipment can be obtained from your Simrad distributor.

Simrad doc.no.519103/F

DET NORSKE VERITAS

QS - CERTIFICATE OF ASSESSMENT - EC

Application of: Council Directive 96/98/EC of 20 December 1996 on Marine Equipment as amended by directive 2002/75/EC, issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Directorate. This certificate is issued by Det Norske Veritas under the authority of the Government of the Kingdom of Norway.

CERTIFICATE NO. MED-D-920

This Certificate consists of 2 pages

This is to certify that the quality system for the

Navigation equipment

with type designation(s) as specified in the appendix to this certificate

Manufacturer

Navico Egersund AS

EGERSUND, Norway

is found to comply with the requirements applicable to it.

The quality system for the product, defined in Annex A.1, Item No. A.1/4, has been assessed with respect to the procedure of conformity assessment described in Annex B, Module D in the directive.

Limitations:

Modifications made to the quality system shall immediately be reported to Det Norske Veritas AS in order to examine whether this certificate remains valid. Annual periodical audits will be held to verify the validity of the certificate.

Place and date
Høvik, 2007-04-25
for DET NORSKE VERITAS AS

Kristen Ulveseter
Manager, MTPNO370
Department Systems & Components

Notified Body No.: 0575

DNV local office:
DNV Stavanger

This Certificate is valid until
2010-03-21

Thomas Rørvik Jacobsen
Surveyor

NORWEGIAN ACCREDITATION PROD 002

Notice: The certificate is subject to terms and conditions overleaf. Any significant changes in design or construction of the product, or amendments to the Directive or Standards referenced above may render this certificate invalid. The product liability rests with the manufacturer or his representative in accordance with Council Directive 96/98/EC, as amended.

If any person suffers loss or damage which is proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million.In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.

Simrad doc.no.519103/F

Cert. No.: **MED-D-920**
Job Id.: 344.1-000726-2
Item No.: A.1/4

APPENDIX, REV. NO. 1

QS - Certificate of Assessment - EC, Certificate No. MED-D-920

Product designation	*EC Type-Ex. Cert. No.*	*Expiry date*	*QS Assessment Report dated*	*USCG approval number*
A.1/4.16: HCS				
AP2000 TRACK	MED-B-4246	2010-03-21	2007-12-10	165.110/EC0575/4246
AP9 MK3	MED-B-4245	2010-03-21	2007-12-10	165.110/EC0575/4245
AP50	MED-B-4179	2010-03-21	2007-12-10	165.110/EC0575/4179
A.1/4.18: SART				
SA50 SART	QQ-MED-33/04-01	2009-11-21	2007-12-10	NA
A.1/4.20: RAI				
RI35 MK2	MED-B-4243	2010-03-21	2007-12-10	NA
A.1/4.30: ECDIS				
CS68 ECDIS	MED-B-4575	2010-02-25	2007-12-10	NA

The manufacturer complies with the Council Directive 96/98/EC on Marine Equipment and is allowed to affix the Mark of Conformity followed by the DNV identification number 0575 and the two last digits of the number of the year in which the product is produced.

Example: ⊙ 0575/07

The manufacturer shall issue a Declaration of Conformity for each product with reference to the EC Type–Examination Certificate and this QS – Certificate of Assessment – EC.

USCG approval and marking

Based on the "Agreement between the United States of America and the EEA EFTA states on the mutual recognition of certificates of conformity for marine" signed 17 October 2005, the manufacturer is allowed to affix the U.S. Coast Guard approval number mentioned in the table above (when applicable).

Place and date
Høvik, 2008-02-15

Arve Løpsøe
Surveyor

DET NORSKE VERITAS * 1864 *

Simrad doc.no.519107F

DET NORSKE VERITAS

EC TYPE-EXAMINATION CERTIFICATE

Application of: Council Directive 96/98/EC of 20 December 1996 on Marine Equipment as amended by directive 2002/75/EC, issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Directorate. This certificate is issued by Det Norske Veritas under the authority of the Government of the Kingdom of Norway.

CERTIFICATE NO. MED-B-4179

This Certificate consists of 2 pages +appendix

This is to certify that the

Heading control system (HCS)

with type designation

AP50 Control Unit

Manufacturer

Navico Egersund AS

EGERSUND, Norway

is found to comply with the requirements in the following Regulations/Standards:

Module B in the Directive, SOLAS 74 as amended, IMO Res. A.342 (IX), IMO Res. MSC. 64 (67) Annex 3, IMO Res. A.694 (17).

Further details of the product and conditions for certification are given overleaf.

Place and date
Høvik, 2007-03-09
for DET NORSKE VERITAS AS

Kristen Ulveseter
Manager, MTPNO370
Department Systems & Components

Notified Body No. 0575

This Certificate is valid until
2010-03-21

Jan Tore Grimsrud
Surveyor

DNV local office:
DNV Stavanger

Notice: The certificate is subject to terms and conditions overleaf. Any significant changes in design or construction of the product, or amendments to the Directive or Standards referenced above may render this certificate invalid. The product liability rests with the manufacturer or his representative in accordance with Council Directive 96/98/EC, as amended.
The Mark of Conformity may only be affixed to the product and a Declaration of Conformity may only be issued when the production/product assessment module referred to in the council directive, is fully complied with.

If any person suffers loss or damage which is proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million. In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.

Cert. No.: MED-B-4179
Job Id.: 344.1-000389-2
Item No.: A.1/4.16

Product description

See Appendix.
For latest revision of the Appendix, see ***http://exchange.dnv.com/tari***

Type Examination documentation

See Appendix.

Tests carried out

- Environmental tests, IEC 60945 (1996/2002)
- Performance tests, ISO 11674 (2000)
- Serial Interface tests, IEC 61162-1 (2000)
- Additionally, performance testing for high speed craft according to ISO CD 16329 is performed

Marking of product

Navico Egersund AS,
AP50 Control Unit
The wheelmark shall be affixed to the Control unit

Mark of conformity

The manufacturer is allowed to affix the Mark of Conformity ⎈ according to Article 11 in the Council Directive 96/98/EC on Marine Equipment and shall issue a Declaration of Conformity, only when the module D or E or F of Annex B in the same directive is fully complied with.

Module D:	The quality system for production and testing shall be approved by the Notified Body.
Module E:	The quality system for inspection and testing shall be approved by the Notified Body.
Module F:	Compliance of the products to type as described in this EC Type-Examination Certificate must be verified by the Notified Body who shall issue a Certificate o Conformity.

USCG Approval

An U.S. Coast Guard approval number will be assigned to the equipment when the production module has been completed and will appear on the production module certificate (module D, E or F), as allowed by the "Agreement between the United States of America and the EEA EFTA states on the mutual recognition of certificates of conformity for marine" signed 17 October 2005.

Cert. No.: MED-B-4179
Job Id.: 344.1-000389-2
Item No.: A.1/4.16

APPENDIX REV. NO. 1 (Page 1 of 2)

Product description

Unit:	Description:	Ident. No.:	Software Ver.	Category*:
AP50	Control Unit	20214045	1.3	Exposed
J50	Junction Unit	20214011	1.3	Protected
JD50	Distribution Unit 24VDC	20126819		Exposed
JD51	Distribution Unit 110VDC	20126827		Exposed
JD52	Distribution Unit 220VAC	20126835		Exposed
JD53	Distribution Unit Analog	20126843	1.1	Exposed
AP51	Remote Control (Optional)	20214052	1.3	Portable
JP21	Jack Point Installation (Optional)	22086433		Exposed
FU50	Follow-Up Steering Lever (Optional)	20214037	1.3	Exposed
R3000X	Remote control (Optional)	22022446		Portable
JS10	NFU Steering Lever (Optional)	22088165		Protected
S35	NFU Steering Lever (Optional)	23241227		Exposed
S9	NFU Steering Lever (Optional)	23601800		Exposed
RF300	Rudder Feedback Unit (Optional)	20193744		Exposed
RF45X	Rudder Feedback Unit (Optional)	22011415		Exposed
RF14XU	Rudder Feedback Unit (Optional)	22506950		Exposed
CD100A	Course Detector (Optional)	20106688		Protected
CD109	Course Detector (Optional)	20121257		Protected
CDI35	Course Detector Interface (Optional)	22087001		Protected
GI51	Gyro Interface (Optional)	20213773	1.2	Protected
NI300X	NMEA Interface Unit (Optional)	22089536	1.3	Protected
TI51	Thruster Interface (Optional)	22089189	1.1	Protected
AD50	Analog Drive (Optional)	20213088	1.1	Protected
RI35MK2	Rudder Angle Indicator (Optional)	22085146	2.2	Exposed

* The category specifies the allowed location for the different equipment according to IEC 60945 (1996/2002)

Cert. No.: MED-B-4179
Job Id.: 344.1-000389-2
Item No.: A.1/4.16

APPENDIX REV. NO. 1 (Page 2 of 2)

Type Examination documentation

Description:	Ident. No.:	Rev.
Operator Manual Simrad AP50 Autopilot	20221032	E
Instruction Manual Simrad AP51 Remote Control	20221016	C
Instruction Manual Simrad TI51 Thruster Interface	20222089	A
Manual Simrad FU25 and FU50 Steering Levers	20221065	E
Instruction Manual Simrad AD50 Analog Drive	20221396	A
Instruction Manual Simrad RI35Mk2 Rudder Angle Indicator	20220919	D
Installation Manual Simrad AP50 Autopilot Plus System	20222410	B
Installation Manual Simrad AP50 Autopilot Standard System	20222469	B
Instruction Manual Simrad GI51 Gyro Interface	20221594	C
Technical Report; Performance type testing of Autopilot system Type AP50	TA: 619	
Technical Report; Performance testreport; DNV type approval for HSC, Autopilot system Type AP50,	TA: 662	
Technical Report; Performance testing of Thruster Interface TI51,	TA: 761	
Technical Report, Type Testing of Autopilot system Type AP50,	DNV Report No. 2002-3131 Revision No 01, 2002-04-08, TA: 177	
Technical Report, Type Testing of Items for Simrad AP50 autopilot and chart systems	DNV Report No. 2004-3514 Revision No 01, 2004-11-19, TA: 738	
Technical Report, Testing of JD5X and QS50	DNV Report No. 2007–3009 Navico report no. 519338	01 A
Technical Report, Test of max voltage on bus	Navico report no. 519337	A
Technical Report, Type Testing of Items for Simrad AP50 autopilot system	DNV Report No. 2003–3440 TA: 688	02

Place and date
HØVIK, 2007-03-09

Jan Tore Grimsrud

END OF CERTIFICATE

Date:	Sign:	MPS Part number:	Rev
19.3.2007	GK	519101	H

EC DECLARATION OF CONFORMITY

We

Description Manufacturer

Company Name:	NAVICO EGERSUND AS
Address:	P.O. BOX 55 N-4379 EGERSUND NORWAY
Telephone no:	47 51462000
Telefax no:	47 51462001

Declare under our sole responsibility that the product(s)

Description product(s)

Description:	Autopilot (heading control system)
Type/model:	AP50 Control Unit with accessories and J50 Junction Unit or JD50 Distribution Unit 24V DC or JD51 Distribution Unit 110V DC or JD52 Distribution Unit 220V AC or JD53 Distribution Unit Analog and optional AP51 Remote Control , JP21 Jack Point Installation , FU50 Follow-Up Steering Lever , JS10 NFU Steering Lever , S35 NFU Steering Lever , S9 NFU Steering Lever , RF300 Rudder Feedback Unit , RF45X Rudder Feedback Unit , RF14XU Rudder Feedback Unit , CD100A Course Detector , CD109 Course Detector , CDI35 Course Detector Interface , GI51 Gyro Interface , NI300X NMEA Interface Unit , TI51 Thruster Interface , AD50 Analog Drive , RI35MK2 Rudder Angle Indicator
Part no:	20214045 with accessories and 20214011 or 20126819 or 20126827 or 20126835 or 20126843 and optional 20214052, 22086433, 20214037, 22088165, 23241227, 23601800, 20193744, 22011415, 22506950, 20106688, 20121257, 22087001, 20213773, 22089536, 22089189, 20213088, 22085146

to which this declaration relates, is in conformity with the following standard(s) or other normative document(s)

Description Standards/ Normative documents applied

Document –Number / Edition			Title/ Description
Regulation	**Applicable SOLAS 74/ IMO Resolutions/ Circulars/ Performance standards**	**Testing standards**	
Regulation V/18.1			
	Regulation V/19.2.8.2		
	IMO Res A.342 (IX)		Recommendations on performance standards for automatic pilots
	IMO Res. MSC 64(67) Annex 3		Adoption of new and amended performance standards
	IMO Res. A.694(17)		General requirements for ship borne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids
		EN / ISO 11674 (2000)	Ships and marine technology – Heading control systems
		IEC/ EN 61162-1 (2000)	Maritime navigation and radio communication equipment and systems – Digital interfaces
		IEC/ EN 60945 (2002)	Maritime navigation and radio – communication equipment – general requirement – methods of testing and required test results
		ISO CD 16329.2	Performance standard for high speed craft

Form_0020H

Date:	Sign:	MPS Part number:	Rev
19.3.2007	GK	519101	H

Approval/ certificates (Module B and D)	Module –B No/ date	4179/ 2007-03-09	Appendix No/ date	01/ 2007-03-09
	Module -D No	920	Appendix No/ date	

Following the provisions of

Description Directive

Directive –Number/ date	Directive – Amendments	Directive -Title	Directive - Modules	Annex
96/98/EC 20.12.1996	98/85/EC, 2001/53/EC, 2002/75/EC	Council directive on marine equipment as amended, issued as "Forskrift om skipsutstyr" by the Norwegian Maritime Directorate	Module B and Module D	A.1, Item No. A.1/4.16 and B

On behalf of (stamp):

Signature: For Geir Henning Risholm **Date:** 19.03.2007

Print name: Geir Vrolijk ..... **(managing director)**

NAVICO EGERSUND AS

AP50 Installation manual, Plus system EN, Doc.no.20222410, Rev.B

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SIMRAD

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